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Post-Pandemic Urban Future: Identification of the main trends of change in Latin America, through the application of the Delphi method

*PhD Candidate **Yeimis Milton Palomino Pichihua** [1]
Universidad Politecnica de Madrid, Department of Urban Planning and Territory Planning (DUYOT) , Spain [1]
E-mail [1]: espacioparalelo.es@gmail.com & milton.palomino.pichihua@alumnos.upm.es

Abstract
The pandemic is a difficult subject to address due to its high degree of uncertainty. This condition is accentuated in Latin America, where limited information hinders any forecasting. Therefore, alternative methodologies are needed to identify the urban effects of the pandemic and its trends. This study applies the Delphi method to gather expert opinions on the influence of the global emergency, systematized in a consensus. Additionally, it employs machine learning algorithms to transform them into predictions. The sample is made up of 26 panelists from different Latin American countries, who participated in successive questionnaires until stable results were reached. The data reveal a pessimistic view of the post-pandemic, as well as a very slight consensus. Inequality is the main topic, while the factors of change are telework, e-commerce and emerging commuting habits. In summary, the research identifies the issues that are shaping the post-pandemic urban agenda.
Keywords: Pandemic; Urban Planning; Uncertainty; Prospective; Latin America.

1. Introduction

This research explores the agreements and disagreements regarding the future of Latin American cities, a prospective exercise focused on the pandemic and its local effects on urban spaces. It considers the opinion of urban planning experts residing in the region because their appraisals manifest the post-pandemic discourse. However, the intention is not to find the generality, but to value the divergent opinions. In this way, the idea of a homogeneous territory, commonly called Latin America, is questioned. Based on interviews and questionnaires, it identifies frequent themes, and then assessing the level of consensus among the participants, who come from different places. The technique chosen was the Delphi method, a procedure that combines qualitative and quantitative analyses to obtain agreements related to a common issue. Despite the age of this method, it maintains validity as a tool for trend analysis, especially when dealing with phenomena in process or lacking information to perform advanced calculations (Rosa-Jimenez, 2022). The opinion of experts in the field enriches the debate on the factors of change capable of driving future events.

Numerous are the studies that reflect on pandemic changes in the city and architecture. However, these tend to offer a partial picture of the phenomenon, focusing on case studies or specific local realities. In response, the present study broadens the horizon by convening nearly thirty specialists from six countries in the region to assess changes that taking place in Latin American cities. It should be noted that the originality of the study lies in the novelty of the phenomenon studied, which is characterized by a high degree of uncertainty because it is a phenomenon that has been constantly changing. Therefore, it is pertinent to analyse pandemic from an urban approach, since it is not only a health problem but also a trigger for new public policies related to the management of the build habitat.

Latin American specificity becomes the key topic of this research. It develops a broad analysis of the effects of the pandemic, seeking to unify the existing narratives and opinions. It identified some ideas, that tendentiously connected to the process of Latin American urbanization, understood as a variant of planetary urbanization. The potential consensus would attest to the effects of a worldwide phenomenon, academically named as a new urban question, global urbanization, post-urbanism, among other terms. In this sense, the effects derived from the pandemic would be nothing more than global effects of urbanization as a dominant historical movement. Although the Latin American context exhibits certain nuances, these would be just sequels of a larger scale process; apparently different but structurally similar. Therefore, concepts such as inequality, segregation, precariousness, etc. become inherent topics of the contemporary city regardless of geographic location.

2. Material and Methods

This is a prospective study of a mixed nature, focused on urban transformations in Latin America during the pandemic. It employs the Delphi method of consensus-building to assess the expert's opinions on the urban trends visible in this region of the world. Complementarily, the research uses predictive methods based on autonomous learning algorithms, which are cross-checked with the conclusions found in the first (interpretative) phase. The main objective is identifying trends of change in such an uncertain scenario as post-pandemic.

2.1. Procedure

It has chosen the traditional Delphi method, which differs from other variants by the application of successive rounds that end once agreement among participants. In a preliminary stage, potential participants (experts) were contacted to gather their impressions on the subject using semi-structured interviews. In this way, it built up an overview of urban concerns arising from the pandemic; this information gave rise to the final agenda. Subsequent stage, it asked participants to give their opinions using a structured questionnaire, successively until completing three rounds, the maximum recommended (George & Trujillo, 2018). It should be emphasized that from the second round onwards, it asked participants to consider the results of the previous phase both individually and as a group, as suggested in the bibliography. This was intended to generate a sense of approval in the participant throughout the process (Mahajan, 1986). Subsequently, it organized results of the third round in a segmented manner, both in isolated questions and in the general sample. It should be clarified that this information reflects the consensus of the panel based on various quantitative indicators. Finally, it should be noted that the process began around July 2021 and ended around November of the same year, approximately five calendar months. Considering the first two months for interview phase and remaining time for the successive rounds of questionnaire.

Finally, the information obtained was used for predictions based on artificial intelligence algorithms, such as Random Forest, Neural Network, Support Vector Machine (SVM) and Naive Bayes. Identifying the probabilities of a future consensus. These results were complementary, as they were compared with their analogues from interpretative phase.

2.2. Participants

For the panel, it contacted professionals and researchers in urban issues from different Latin American countries after searching for profiles through academic repositories. Subsequently, it communicated to candidates via e-mail to request their participation. The selection criteria were academic publications, teaching experience and professional practice in urban planning. Initially, thirty-two panellists participated in the individual interviews; it subsequently reduced this number to twenty-six and finally to twenty-five in the final round (consensus). It should be noted that it guaranteed diversity in terms of place of origin, a key factor in forming a global Latin American panorama.

It made up the final panel of experts from six different countries: Peru (21.7 %), Mexico (17.4 %), Brazil (17.4 %), Chile (17.4 %), Colombia (13 %) and Argentina (13 %). Participation was anonymous; however, it is possible to mention some general data. The panellists with a doctoral or PhD degree (74%) stand out, while the rest have a master's degree (26%). Likewise, most of them are currently teaching at the undergraduate level (78.2 %), while the remaining percentage indicate that they have suspended this activity. Finally, regarding experience in urban planning, those experts with more than ten years (78.3 %) and those with between five and ten years (8.7 %) of professional practice stand out.

2.3. Tools

It developed the study remotely, using various digital tools. Email was the main tool used to initiate communication with the panellists, the interviews and later helped to maintain contact during the rounds of questionnaire. Initially, it developed brief meetings through videoconferencing; while the second phase (questionnaire) it used the Google Forms application exclusively, to point out that this facilitated responses processing during the study.

Subsequently, it used data mining methods to process the information. Free software Orange Data Mining, specialized in predictive algorithms, stands out. For this purpose, it built a database from successive responses of the panellists, which were subsequently transferred to the software. It automatically executed algorithms and then compared in a confusion matrix, where it has shown the different probabilities of agreement or disagreement simultaneously.

2.4. Questionnaire

It resulted in final questions from the exploratory phase, semi-structured interviews. In this phase, the topics that aroused it evaluated the greatest interest in participants. It should be noted that it reduced the initial set of questions after the preparatory round, in which it examined the clarity of the sentences and the dispersion of the sample. In this way, questions whose answers were highly variable, i.e., a high deviation, were omitted. It composed the final questionnaire of fifteen statements, grouped into three thematic units: consequences of the pandemic, changes in urban regulation and trends of change. It scored affirmative statements using a Likert scale, consisting of four categories and their values: “strongly disagree” (1), “disagree” (2), “agree” (3) and “strongly agree” (4). As suggested by the literature, this strategy organizes the responses based on ordinal data susceptible to calculations of consensus (Reguant & Torrado, 2016).

2.5. Selection and interpretation of indicators

This study seeks to identify consensus among the participants because this condition can be quantified by various indicators. As it is flexible, the Delphi method allows the calculation to be chosen according to the nature of the questionnaire and the panel of experts. The basic indicators are the mean (AVERG), median (MED) and standard deviation (SDEV); these provide a general idea of responses translated into scores. In this first stage, mean high value translate into the predominance of categories such as “agree” (3) and “strongly agree” (4), i.e., the positivity degree in the responses. In contrast, the standard deviation represents the smallest dispersion of the sample. Both interpretations focus only on affirmation, leaving aside negative responses, also capable of building consensus. Subsequently, it used a second group of specific indicators.

In a second stage, the interquartile range (IQR), relative interquartile range (RIR) and Kendall's coefficient (K) were calculated. These indicators make it possible to identify the global consensus, considering the division into cohorts or segments. They also compare the dispersion values for each question versus the overall sample, thus providing a more detailed panorama of opinions. It should be noted that in this second group of indicators, the higher the value, the greater the agreement, whether positive or negative.

Finally, predictive algorithms such as Tree (T), Random Forest (RF), Support Vector Machine (SVM), Neural Network (NE) and Naive Bayes (NB) were used to calculate trends. These can correct their results from iterative computations until it achieved a stable model. As explained above, these were run in Orange software, which allowed comparing the performance of each prediction, to choose the most efficient model (algorithm) for the sample. It should be clarified that in this last phase, the sample was the set of responses obtained in the three successive rounds, not only from the final round. The resulting probability matrix considers the questions of the questionnaire and the incidence of the four corresponding levels of agreement (values 1, 2, 3, 4).

Table 1. Final questionnaire.

Thematic	Code	Statement	Rating
Pandemic consequences	A.1	Pandemic has accentuated the socio-spatial inequalities of our cities.	Likert scale, four levels
	A.2	Confinement measures and other restrictions ended up polarizing the cities even more because these had a differential impact on urban space.	*Idem.*
	A.3	Pandemic has prompted emergency measures focused on housing problem mitigating, in terms of deficits and overcrowding.	*Idem.*
	A.4	Pandemic has prompted emergency measures focused on alleviating public space deficit in our cities.	*Idem.*
	A.5	Pandemic has prompted emergency measures to face new public transport demand	*Idem.*
	A.6	Pandemic has contributed to the positioning of alternative urban transport modes, such as non-motorized means of transport.	*Idem.*
Changes in urban regulation	B.1	Pandemic has unleashed regulatory mechanisms on public spaces, which have distorted their social and collective condition.	*Idem.*
	B.2	It has strengthened legislation promoting teleworking and remote education, favouring it over other modalities.	*Idem.*
	B.3	Pandemic has motivated local governments to implement new strategies to guarantee the coverage of services, such as health, education, supplies, among others.	*Idem.*
Trends of change	C.1	Pandemic will significantly transform the way we think about and manage our cities	*Idem.*
	C.2	Both national and local governments will significantly reformulate their urban legislation to address the pandemic city emerging problems	*Idem.*
	C.3	Diffusion of remote work and distance learning modalities can transform the form and functioning of our cities	*Idem.*
	C.4	Emerging economic activities, such as e-commerce, delivery, couriers, among others, will significantly modify the functioning of our cities and will motivate new urban policies.	*Idem.*
	C.5	Telework and other remote modalities will transform mobility patterns in cities in the long term, i.e., their impact will not be temporary.	*Idem.*
	C.6	Return to normality, motivated by the vaccination processes, will be able to reverse the changes that our cities have undergone during the pandemic, in terms of urban form and function.	*Idem.*

3. Results

As mentioned, it obtained consensus around the third-round questionnaire. The evolution of the indicators was positive only regarding standard deviation and Kendall's coefficient, while the rest of the values remained stable or even decreased. A general increase in consensus during the process is evident; however, its magnitude is not remarkable. The literature suggests that the results are significant when values equal to or greater than 0.7 in Kendall's coefficient and less than 0.1 in the relative interquartile range (Zartha-Sossa et al., 2019) are reached. The values of the study are far from these standards. Therefore, it can be concluded that the consensus obtained is mild or moderate; however, its evolution proposes a future increase.

Similarly, when it analysed questions individually. In this case, it evaluated both the degree of agreement/disagreement estimated by the cumulative score and dispersion of the responses. In the first place, the sentences where the highest and lowest values predominated stand out. On the other hand, the high variability of the responses is evident, since only five of the fifteen initial questions kept their standard deviation constant and even managed to reduce it during the process. This fact can be interpreted as an answer's stability. Only statement A.1 has a high degree of agreement from its positivity, while the remaining statements are consistent from the negation. Finally, the ideas with the best performance in both categories were: "Pandemic has accentuated the socio-spatial inequalities of our cities", "Pandemic has prompted emergency measures to face new public transport demand" and "Pandemic has prompted emergency measures focused on alleviating public space deficit in our cities". Clarifying that only the first one has a high positivity.

In case of predictions, it evaluated the degree of accuracy of the algorithms, where the performance of the Neural Network (NE) algorithm stands out above the rest. Therefore, the results are exclusive of this method. For clarity, it grouped the probabilities according to the four levels of consensus and are also separated individually by question (Figure 1). The results show a balance between agreement and disagreement in the overall sample, translated into a distribution of eight items for the first camp and seven items for the second. Likewise, opinions are mostly moderate (values 2 or 3), contrasting with the low incidence of extreme values (1 or 4). Finally, a comparison of the results of the Delphi method and these predictions reveals a great similarity. It repeated the evaluations except for two questions, A.4 and A.5, where it accentuated the degree of disagreement (Table 2).

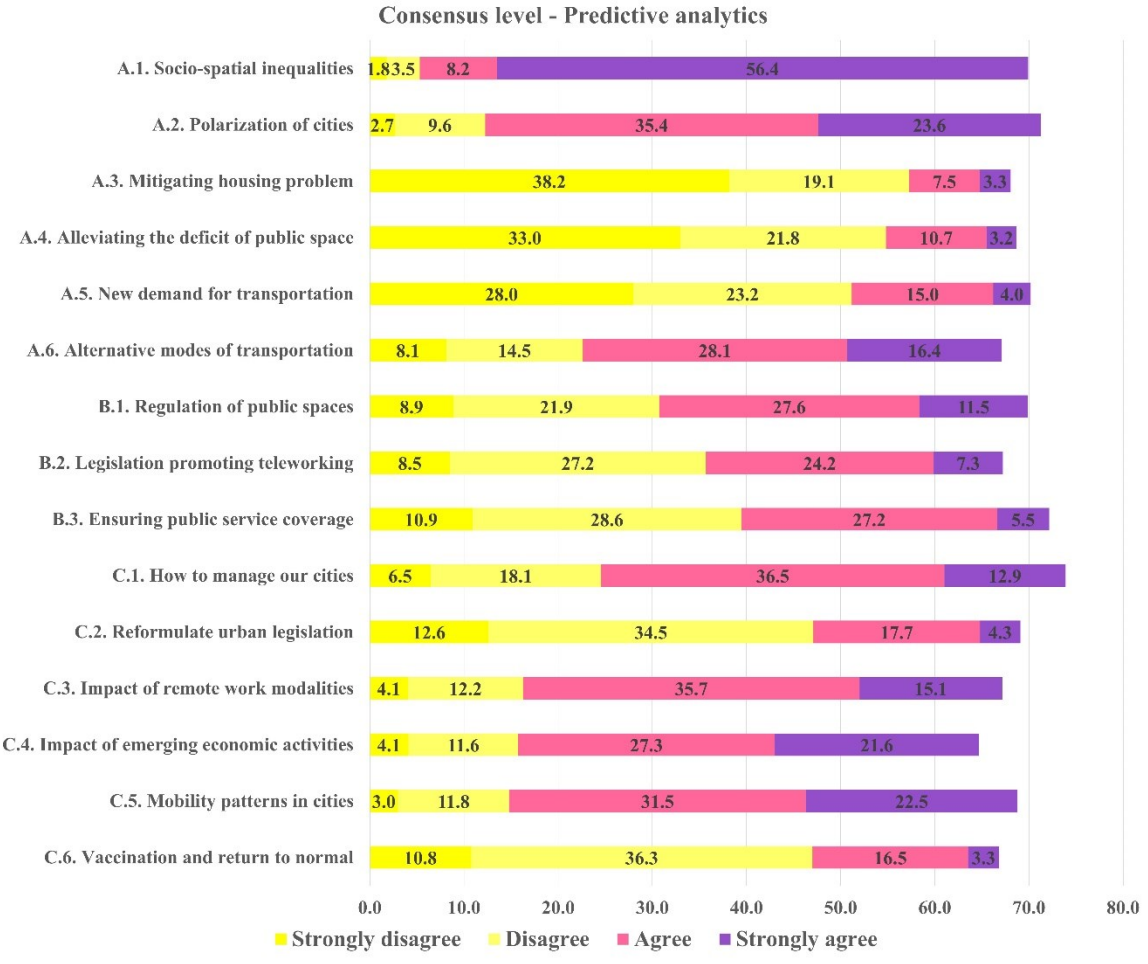

Figure 1. Predictive analysis based on algorithms, neural network method.

Table 2. Comparison of results, Delphi method versus predictions.

Idea	DELPHI		ALGORITHM	
	Median	Consensus	Value	Prediction
A.1. Socio-spatial inequalities.	4	Strong Agreement	56.4	Strong Agreement
A.2. Polarization of cities.	3	Agreement	35.4	Agreement
A.3. Mitigating housing problem.	1	Strong disagreement	38.2	Strong disagreement
A.4. Alleviating the deficit of public space.	2	Disagreement	33.0	Strong disagreement
A.5. New demand for transportation.	2	Disagreement	28.0	Strong disagreement
A.6. Alternative modes of transportation.	3	Disagreement	28.1	Disagreement
B.1. Regulation of public spaces.	3	Disagreement	27.6	Disagreement
B.2. Legislation promoting teleworking.	2	Disagreement	27.2	Disagreement
B.3. Ensuring public service coverage.	2	Disagreement	28.6	Disagreement
C.1. How to manage our cities.	3	Disagreement	36.5	Disagreement
C.2. Reformulate urban legislation.	2	Disagreement	34.5	Disagreement
C.3. Impact of remote work modalities.	3	Disagreement	35.7	Disagreement
C.4. Impact of emerging economic activities.	3	Disagreement	27.3	Disagreement
C.5. Mobility patterns in cities.	3	Disagreement	31.5	Disagreement
C.6. Vaccination and return to normal.	2	Disagreement	36.3	Disagreement

4. Discussions

Results reinforce the idea of Latin America as a complex and asymmetric region, a condition that makes it difficult to build a homogeneous discourse. Examination of the urban effects of the pandemic reveals its asymmetrical impact on both territories and cities (Desai, 2020). Likewise, there are opinion divergences among experts, apparently linked to residency of the participants. The measures to contain the pandemic were local, and therefore partial and discontinuous because it depended on a specific political situation. This shifts the debate to cities governance, to the decision-making processes, which it marked in health emergency by the dilemma between the urgency and the importance of public policies.

Visions of the post-pandemic city are pessimistic. Because widespread uncertainty uncovered pre-existing dysfunctionalities or urban risk factors (Elavarasan et al., 2021); however, it has gradually diluted its renewing effect. The increase in inequality, a direct effect of the pandemic, became the dominant narrative both in Latin America and globally (Boza-Kiss et al., 2021). Perhaps the only redeemable fact of this emergency is a renewed interest in urban issues such as transportation, land use, densities, centralism, proximity, among others. This attention has been shaping a post-pandemic urban agenda that goes beyond academia to become part of public opinion. Fuelling the debate on the need for structural public policies that go beyond the conjuncture and immediacy (Parnell, 2020).

Opinions analysed emphasize the inaction of local governments because the measures applied in Latin American cities had a slight impact on pandemic progress. In other words, they did not manage to mitigate the emergency effects, nor did they address pre-existing problems such as the deficit of public spaces, public transportation coverage and access to housing. Likewise, experts' perception reveals a pessimistic outlook about regulation because there is not enough evidence to think of a significant change based on either national or local legislation. Most Latin American countries only took palliative, transitory and reversible measures; these focused on general points such as limiting displacement and supporting certain economic sectors, within the framework of a state of emergency (Ylarri, 2020). In other words, urban issues were not the core of these initiatives.

Not all conclusions are negative, there is a tendency to recognize that we are witnessing a new normality, in general terms, and a new urbanity (Soliman, 2021), in specific terms. In other words, conditions imposed by the pandemic are leading to new modes of coexistence, if it maintained, could significantly transform cities. By the results, the positive factors of change are telework, e-commerce and alternative transportation. These would be able to reconfigure people's habits and therefore the urban activities thought from the demand scope. It should be noted that this trend synthesizes into the emerging virtuality; an opportunity that should be evaluated from the pre-existing digital gap in Latin America (Batthyány & Sánchez, 2020).

Finally, it is point out mentioning the methods used both in the search for consensus (Delphi) and in trends identification (algorithms). For both approaches provide valuable information on a common theme. The problem with studying an issue as elusive as the pandemic is the lack of reliable information. Therefore, the contribution of experts from different countries contributes to build a global vision of the phenomenon. Without intention of generalizing or finding conclusive answers, but rather with intention of preliminarily identifying factors of urban change.

5. Conclusions

Pandemic has exposed existing urban issues while consolidating a vague idea of an alternative future. Its urban effects are not entirely clear and vary significantly from one city to another and from one country to another; therefore, it is impossible to construct a single narrative about the post-pandemic future. In Latin America, the complexity of the territory and the political contexts intervened as factors of the global emergency performance. The realities are different; however, it is possible to establish a subtle consensus on the urban transformations of the present and recent past, as well as the change trends. This is done by consulting experts in urban studies because their assessments offer an interesting interpretation that needs to be compared with reality facts.

In general terms, it demonstrated the palliative and fleeting nature of the measures taken in pandemic, whether of a practical or regulatory nature. It has missed these change opportunities, or it has gradually reversed by the emergency evolution. The new urban normality has no clear form; however, it is possible to connect it with virtuality and all its implications in the future (Neuman et al., 2021). It has shown this trend as both a threat and an opportunity, which needs to be addressed by governments to lay the foundations for a sustainable future.

In summary, the urban panorama in Latin America is not optimistic. Nevertheless, there is growing interest in specific urban issues such as transportation, housing and public space. These can mobilize diverse social actors and urban decision makers to build a shared vision of the future. The new urban agenda in pandemic (Stiftel, 2021) to make our cities fairer places; because, as explained, the most relevant problem is the increase in inequalities. Finally, to underline the need for appropriate regulatory frameworks, focused on emerging issues from a structuring vision and a conjuncture one because regulations can change cities from within.

Conflict of Interests

The authors declare no conflict of interest.

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