



The sound's dynamics in street markets during the Covid-19 pandemic: a case study at Tabuleiro Market, Maceió-AL, Brazil

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ABSTRACT

Faced with the pandemic caused by Covid-19, with recommendation of social isolation, large part of the population with lower purchasing power, living in the peripheries of Brazil, has faced difficulties in meeting the social isolation recommended by the World Health Organization. In these spaces, sociabilities are exercised in public areas of the city, such as street markets, stage of various social, cultural and economic dynamics. With various sounds, street markets mark the local soundscape. This study analyzes the sound impact caused by the commercial nucleus of one of the largest street markets in the State of Alagoas and the relationship of this impact with the acoustic perception of users, from the scenarios: before and during the pandemic. This is the Tabuleiro Market, located in Maceió, Alagoas, Brazil. The methodological steps were applied: characterization of the object of study, land use and occupation; survey of objective sound data (acoustic measurements) and subjective data (questionnaires applied to users). Results indicate that even in the face of the pandemic, this street market still resists. For users, sounds related to the buying and selling process are taken as a natural part of the street market, so that its absence would rule it out.

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1. INTRODUCTION

Since the beginning of street markets, one of the oldest forms of retail trade, there has been a prominence of them in terms of their importance for the spatial development of cities. Stage of diverse dynamics, varied sounds, relationships and flows of people and vehicles, the street markets demonstrate social function, with historical profile and identity, transform the urban physical space and behave as a point of convergence in cities. "In Brazil, this activity, for a long time, was the contribution of the food supply of the villages, thus being responsible for the emergence of several urban settlement nuclei in the country". [1].

The functioning of Street markets makes it possible to perform several commercial activities. As the supply and variety of products increases, its target audience is broadened and thus there is a tendency for local pedestrian and vehicle traffic as well as temporary economic activities - for example, street traders. As a consequence of these urban changes, the sounds generated in cities are now produced and perceived with more intensity, either positively or negatively (noise).

However, the perception of noise in the community is sometimes masked by the population using this space, since they are regularly immersed in this environment and are often socially and culturally involved in its formation. The establishment of commercial establishments, such as street market, also generates changes in local vehicular traffic, in addition to the increase in the flow of pedestrians due to the population's demand for the products and services offered.

In order to sell or buy products, traders and customers move from their region, going beyond regional, municipal or state borders and marking a rotating movement of spatial distribution that makes the street markets places of constant commercial and human mobility providing the socioeconomic and cultural manifestation [2].

With various sounds, street markets mark the local soundscape. The sound environment and the acoustic perception of outdoor markets, very common in high density urban open spaces, play important roles in terms of urban soundscape [3].

Faced with the pandemic caused by Covid-19, with the recommendation of social isolation, a large part of the population with lower purchasing power, living in the peripheries of Brazil, has faced difficulties in meeting the social isolation recommended by the World Health Organization. While the number of cases of coronavirus has been increasing exponentially in Brazil, the isolation rate remains low, especially in peripheral neighborhoods. In the city of Maceió, Alagoas, Northeast region, Brazil, during the months of quarantine, empty streets were observed in the noble areas and busy streets in the poorest neighborhoods. It is precisely in these peripheral areas that Covid-19 propagates faster and with greater lethality [4]. In this sense, in the peripheral neighborhoods, local commerce and street markets, for the most part, continue to operate, with an attempt to maintain local processes and dynamics.

This study analyzes the sound impact caused by the commercial nucleus of one of the largest street markets in the State of Alagoas and the relationship of this impact with the acoustic perception of users, from the scenarios: before and during the pandemic. This is the Tabuleiro Market, located in Maceió, Alagoas, Brazil.

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2. METHODS

This study was conducted in two steps, described below:

2.1. First step: characterization of the object of study, land use and occupation

In the city of Maceió, capital of the State of Alagoas, Northeast, Brazil, whose population according to the latest population census is 932,748 people [5], there are six street markets located in different neighborhoods, as shown in Figure 1. These six street markets attend both the city's neighborhoods, as a whole, and buyers from the adjacent cities, and have different dimensions and configurations, the largest and most influential being the Tabuleiro Market (5), Jacintinho (4) and Benedito Bentes (2); and the smallest and most influential are Jatiúca Market (1), Cleto Marques Luz (3) and Village Campestre (6).

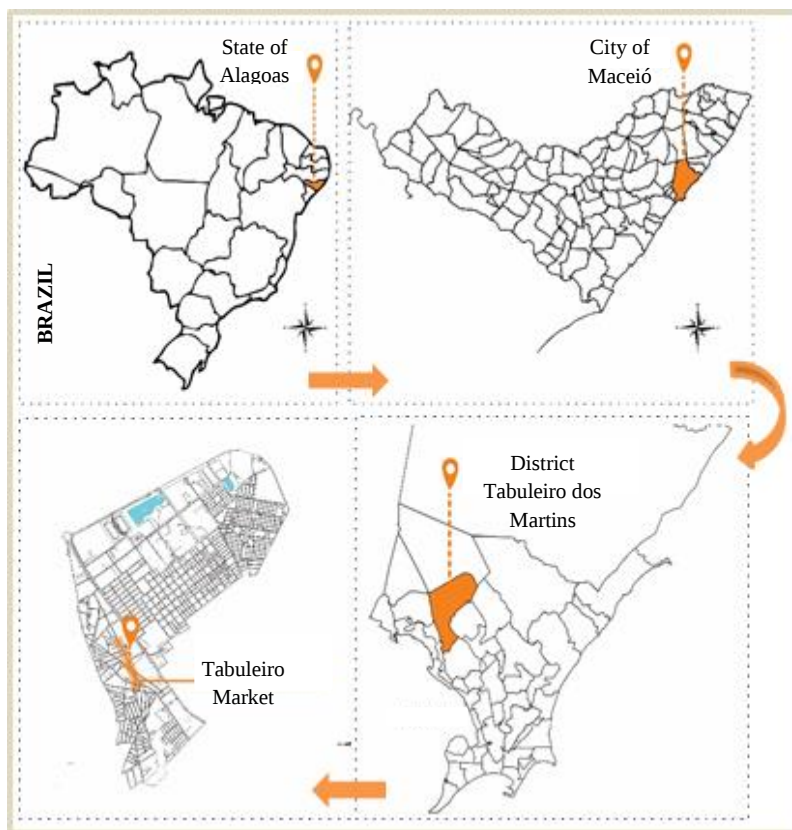


Figure 1: Location of the streets markets in the city of Maceió, State of Alagoas, Northeast, Brazil.

For the study in question, it was selected, among the existing street markets in the city of Maceió, the Tabuleiro Market, located in a peripheral neighborhood of Maceió. Originated from the Public Market of Tabuleiro, initiated in the year of 1960, goes beyond the limits of the municipal market and the street market itself that, currently, occurs in a land made available by the Municipal Government in the Maceió Avenue and enters close streets, and counts on the implantation of innumerable commercial establishments in its surroundings. Thus, the Tabuleiro Market is not only about the existing free market, but also about a commercial region of great importance located in the Tabuleiro dos Martins district, as shown in Figures 1 and 2.



Figure 2: Tabuleiro Market - before the COVID-19 pandemic: (a) Main avenue and (b) Street market in one of the streets that are part of the Tabuleiro Market.

Data previous to the pandemic by Covid-19, the Tabuleiro Market was composed of 800 traders, in addition to street traders who settle around it and make available a wide variety of products and services, from horticultural products to industrial products such as clothing and shoes. Its opening hours are from Sunday to Sunday, from 07:00 to 17:00. Throughout the week the number of users, as well as the number of merchants and street traders increases, since a significant number of users come from other municipalities. Therefore, the weekends are days of greater local movement.

Every Sunday, the nearby streets were blocked by market stalls, forming the street market that took place for many years in the open air in the neighborhood streets. According to reports from the community, within its spatial dynamics, on Sundays, the street market used each street to sell a specific product. As the years went by, many stalls were installed near the sidewalks and at the ends of the streets on a daily basis, which hindered the flow of pedestrians and vehicles in the area. About 15 years ago, as a mitigating measure, the Municipal Government made available a piece of land in the vicinity and directed all the market stalls to the locality.

The analysis of the types of land use in the region allows the identification of residential, commercial, institutional and industrial areas in order to obtain a list of the activities performed in each building in the study area and the local urban noise. For this phase, the cartographic base of the Tabuleiro dos Martins neighborhood was initially used, made available by the Municipal Government with the help of the online tool GoogleMaps [5], which allows the viewing of 360° images at street level. Maceió Avenue, currently the main avenue of the locality, for example, was the street of the clothes stalls. As the years went by, many stalls were installed near the sidewalks and at the ends of the streets on a daily basis, which hindered the flow of pedestrians and vehicles in the area. About 15 years ago, as a mitigating measure, the Municipal Government made available a piece of land in the vicinity and directed all the market stalls to the locality.

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Figure 3: Profile map of use of the studied cutout. Source: Maceió map base, 2010. Adapted by the authors, 2018.

2.2. Second step: survey of objective sound data (acoustic measurements) and subjective data (questionnaires applied to users)

Objective and subjective data were collected in view of the two scenarios: before the pandemic (in 2018), and during the Covid-19 pandemic (in 2020).

Two points were determined for the collection of objective data, obtained through the measurements of sound pressure levels, corresponding to the places where the device for sound measurement was positioned. The measurements of sound pressure levels were performed in both scenarios, i.e., before and during the pandemic. For the choice, factors such as: proximity to points of greater convergence between merchants, pedestrians, vehicles, observed on site, in order to cover the various existing sound dynamics, were taken into account. Therefore, the selected points of the street market can be observed in Figure 4.

The procedures established in NBR 10151 - Acoustics - Measurement and assessment of sound pressure levels in inhabited areas - General purpose application [7] were followed to perform sound pressure level (SPL) measurements. The measurements were made by adopting the soil sound pressure meter of 01dB that already shows the weighted average of sound pressure levels (LAeq) so that it was calibrated just before starting each measurement period and positioned at a height of 1.20m, as required by NBR 10151 [7]. The equipment remained at a minimum distance of 2m from the limit of the buildings near each measurement point.

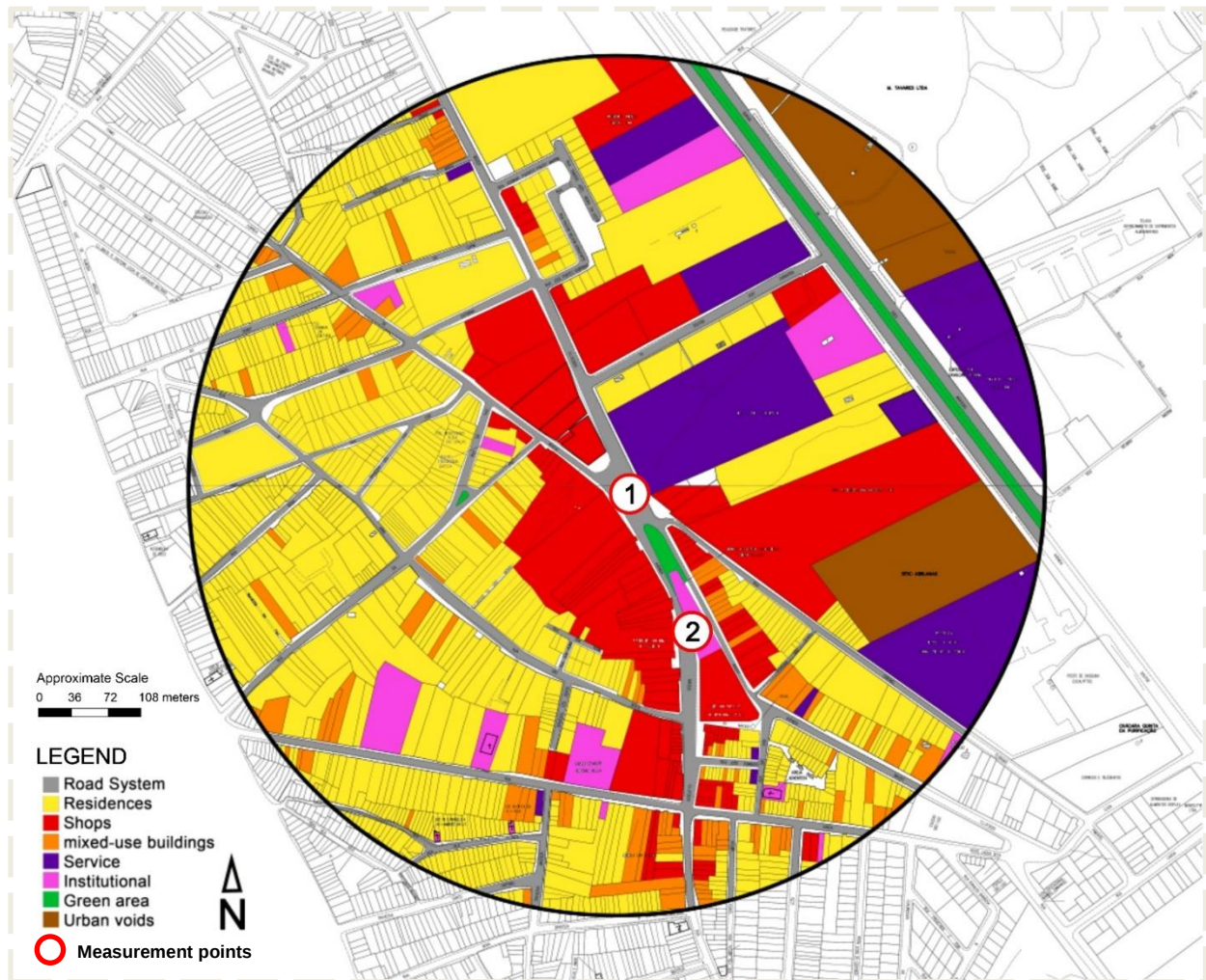


Figure 4: Location of sound measurement points.

Each sound measurement was performed for a period of 5 minutes. Along with the survey of Sound Pressure Level (SPL) measurements, vehicles that traveled along the road where the measurement point was located were also counted, and this quantity was divided between light vehicles (motorcycles and cars) and heavy vehicles (buses and trucks).

In order to map the sound perception of the users and their discomfort in the face of the sounds produced through the activities carried out at the street market, a questionnaire was applied to its users in the year 2018, before the pandemic. To collect these subjective data, the non-probabilistic sampling process was used [8], as the respondent group includes street traders, marketers and consumers of the locality, and it is not possible to determine a finite quantity due to the variability of the days of the operation. In total, questionnaires were applied to 30 users, during the purchase period, by consumers and sales, by merchants and shopkeepers. The questions involved information about the activity on site (if consumer or marketer/trader); opinion about the sound environment (if noisy or not) and whether they were bothered by the sounds coming from the street market (Table 2).

Table 2: Questionnaire applied to the users of the locality Tabuleiro Market.

1. Are you a marketer or a consumer in the locality of the Tabuleiro Market?			
Marketer/trader		Consumer	
2. Do you think the Tabuleiro Market is noisy?			
Yes		No	
3. Does this bother you? If so, how much?			
No		A little	
		A lot	

It was not possible to apply the questionnaire during the pandemic, due to the possible risks involved in having contact with the public, however, in the study of this scenario, the subjective evaluation of the sound dynamics of the Tabuleiro Market was carried out through the perception of the researchers who carried out the paper.

Moreover, in the two scenarios studied, that is, before and during the pandemic, photographic surveys were carried out along the measurements, video recordings and audios characteristic of the street market, in order to allow a total immersion in the environment analyzed. The recordings and images were made through a mobile phone.

3. ANALYSIS AND DISCUSSION

In order to analyze the sound impact caused by the commercial nucleus of the largest street market in the city of Maceió, capital of the State of Alagoas, Brazil, and the relationship of this impact with the acoustic perception of users, from the two scenarios: before and during the Covid-19 pandemic, discussed below.

As previously mentioned, measurements of sound pressure levels were performed at two points along the main avenue of the Tabuleiro Market, named as point 1 and point 2, with buildings in the predominantly commercial surroundings.

In Figures 5 and 6, it is possible to observe the two points analyzed, point 1 and 2, in photographic records prior to the Covid-19 pandemic. Point 1 is in the central point of the locality Tabuleiro Market, it is the area that gathers the largest amount of market stalls, and receives interference from several sound sources, coming from marketers, street traders, parking attendants, sound boxes of the local radio, sound cars and vehicular traffic. Point 2, shown in Figure 6, is located in front of a large commercial establishment, the largest supermarket in the region, which ends up intensifying the flow of people and vehicles in the area.



Figure 5: Point 1 of the street market – before the COVID-19 pandemic.



Figure 6: Point 2 of the street market – before the COVID-19 pandemic.

In Figures 7 and 8, the photographic record of the two points under analysis was taken during the Covid-19 pandemic. By performing a comparative analysis between the records it is possible to identify an equivalent movement of pedestrians and vehicles in the images preceding the pandemic and the records during it. Furthermore, given the existing determinations for social distancing and staying at home, the movement recorded during the pandemic is visually significant, which opposes all the determinations and accentuates the risk of contamination.



Figure 7: Point 1 of the street market – during the COVID-19 pandemic.



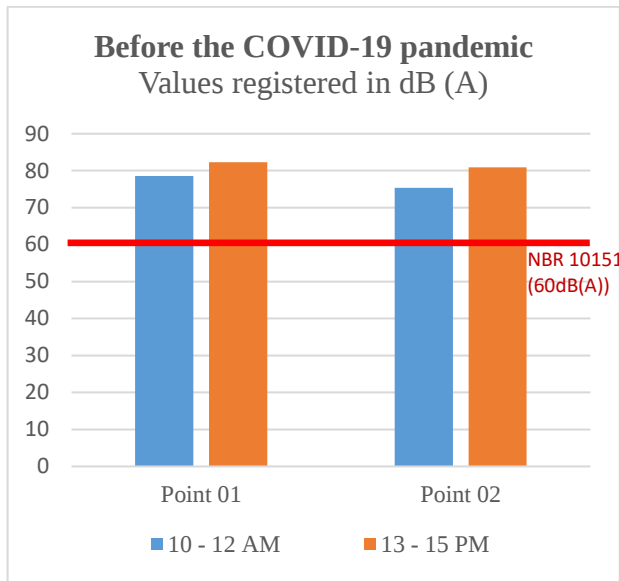
Figure 8: Point 2 of the street market – during the COVID-19 pandemic.

From the observation of researchers in the area, the similarity in terms of the sensations of overcrowding that exist in the independent region of the period was verified. In both moments, the movement of pedestrians, vehicles, street traders were equivalent as shown in Figure 9. The main difference noted is the use of protective masks, however, underscores the partial and inadequate use by passersby and users of the street market.

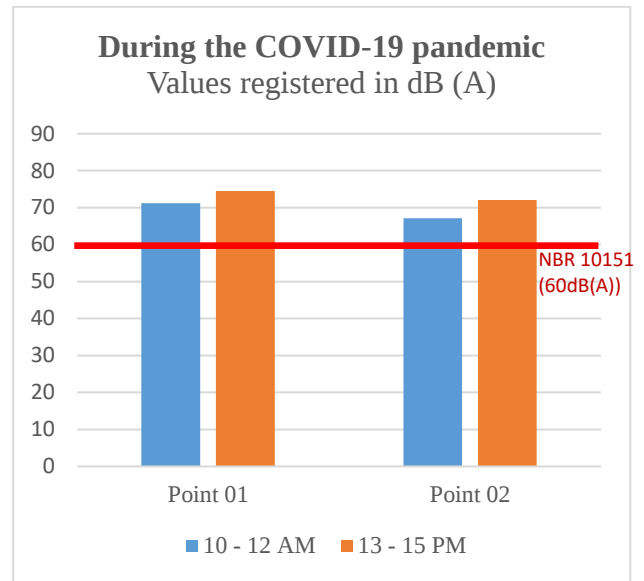


Figure 9: Street market – during the COVID-19 pandemic.

As for the objective data, the values obtained in the measurements of the sound pressure levels are presented in Graph 1. All measurements exceed the values stipulated by the Brazilian standard NBR 10151 [7], which in turn defines the evaluation criteria level, with a limit of up to 60 dB(A). When comparing previous measurements and during the pandemic, although it identified a difference between 7 and 8 dB(A) between the two situations, visual perception of local dynamics and sound perception reveal the continuity of local activities in a similar way. This is due to the fact that the majority of commercial establishments have businesses and services that are considered essential to the population, which in none of the decrees issued as of March 17, 2020 by the State Government were unable to function, however, despite the determination to control entry into all commercial establishments avoiding internal agglomerations and the availability of alcohol gel, only a small portion of the establishments were complying with the determinations, whose inspection was non-existent during the period in which the researchers remained in the locality.



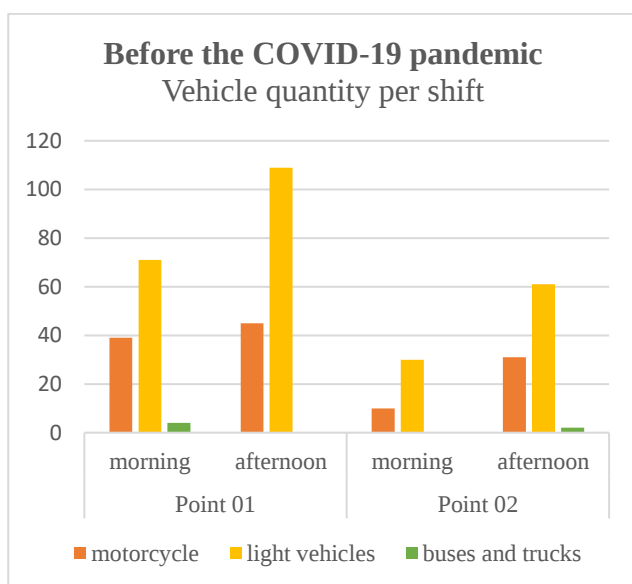
(a)



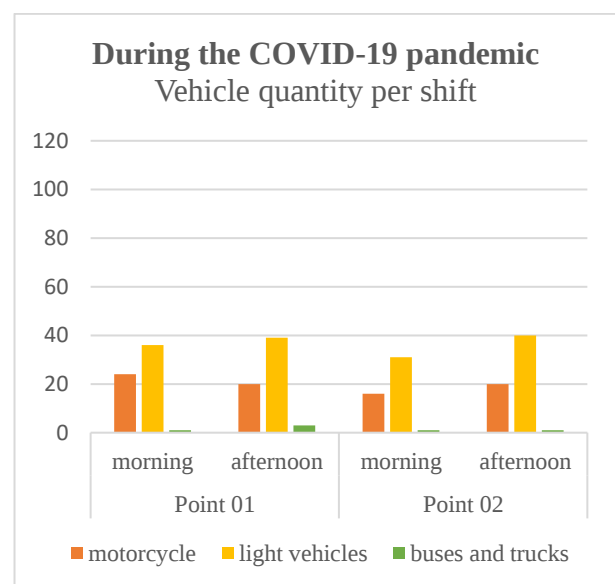
(b)

Graph 1: Summary of sound pressure levels: (a) before the pandemic and (b) during the COVID-19 pandemic.

In local observations, in the experience of the place, it is possible to notice the presence of the vehicles, composing the local dynamics, whether motorcycles, light vehicles, buses and trucks. When comparing the number of vehicles that passed along the measurements, the pre-pandemic values are higher than the quantitative identified during the pandemic, considering the day of measurement (Graph 2). Given these results, it is possible to characterize this factor as determining the decrease in previously verified dB(A) levels, since local traffic in the region occurs in a disorderly manner and without adequate traffic signs, causing and narrowing of lanes from inadequate parking of vehicles and pedestrians. This situation causes horn sounds, as well as noises from acceleration and braking, which get worse as vehicles increase in the area.



(a)



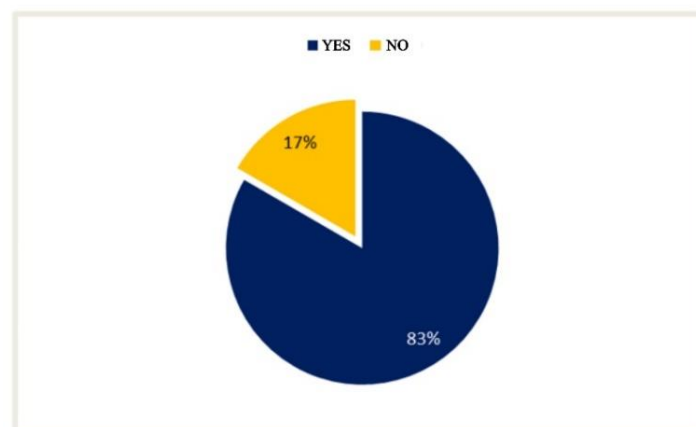
(b)

Graph 2: Vehicle quantity per shift: (a) before the pandemic and (b) during the COVID-19 pandemic.

The investigation of the sound impact through sound measurements allowed the identification of sound as noise, by relating the values obtained with the standards suggested by the Brazilian norms, through an objective assessment. However, it became essential to investigate the sound perception in a subjective assessment. It is worth mentioning that the application of the questionnaire to the users of the Tabuleiro Market occurred before the Covid-19 pandemic, it was not possible to apply it during the pandemic, due to the possible health risks, so the sound perception during the pandemic was apprehended by the researchers responsible for performing this paper.

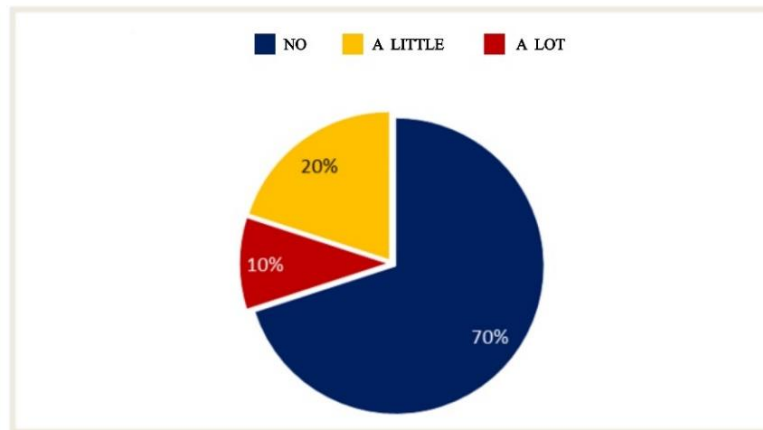
The main objective of applying the questionnaires to users is to identify how they relate to the sound of the street market, adding knowledge about the dynamics and experiences of the location. Thus, they were identified as merkaters/street traders and users and questioned about the existence of noise at the street market and its level of nuisance.

We interviewed 30 people, 15 merkaters/street traders and 15 consumers who were in the area doing their shopping or who were in their stalls and stores doing their sales. This division was intended to avoid that the social/economic relationship of the interviewees with the street market interfered in the overall results. When asked whether the street market was noisy or not 83% of those interviewed answered yes, as shown in graph 3. The great majority of the remaining 17% (10.2% merkaters/street traders and 6.8% consumers) followed their negative answer with some justifications: "Noise? No, if there is no noise there is no sale"; "The street market is not noisy, without noise there is no street market". In view of these comments, the link between sound production and the functioning of local commercial activity and the influence of the economic relationship on users' sound perception is visible. On the other hand, the consumers interviewed reported that they did not stay in the place long enough to observe this sound factor.



Graph 3: Existence of noise on the Tabuleiro Market for users.

And finally, the fundamental question for the subjective evaluation of this study highlighted in graph 4: *Does this bother you? If so, how much?* For 70% (39.56% of marketers and street traders and 30.4% consumers) of the interviewed users, the noise registered at the street market does not bother them. For those who felt annoyed, 20% classified the sound as very annoying, of these 10% were marketers and street traders and the other consumers, presenting similarity in the results, regardless of the economic/social relationship with the place. 10% of those who were uncomfortable registered little inconvenience. Among the 70% who said they were not bothered by the noise, there were comments such as: "this noise is normal at a street market anyway"; "noise means there are people and people means there are sales"; "You have seen selling without people?".



Graph 4: Level of discomfort perceived by users.

Although sounds are considered noise in view of the exclusively objective parameters achieved through sound meters, after the presentation of the local sound picture, it is important to check the annoyance of those who are really affected, the users, to whom the research is directed. Thus, the perception and consequently its opinion, investigated through the application of questionnaires, served as a subjective parameter for the understanding of the relativity of factors behind the noise nuisance, for the knowledge of the existing subjectivity in determining a sound as noise or not.

4. CONCLUSIONS

In the sound field, the Tabuleiro Market presents sources from the buying and selling processes of the buy and sell, the traffic intensified and allocated in the nearby streets, tents scattered on the sidewalks, pedestrians, sound boxes in front of commercial establishments and speakers scattered along the streets in the lamp posts for the local radio transmission of the street market. With the recognition of local sound sources, this study sought to identify the sound impact that the street market brings to the region and how much it interferes with the local sound profile.

The final result of the questionnaires confronts the technical and normative results presented so far and states that the sound perception of individuals is influenced by the individual's view of the behavior of the space analyzed, since for many the use of the space for sales already presupposes noise and their economic or identity relations, a feeling of belonging that arises with the frequency that you are in a space and makes use of it transforms the critical way we see the behavior of the same as it was perceived in the course of the applications of the questionnaires to the merchants and street traders.

It was observed that, even in face of the pandemic, the studied street market still resists and, in face of the attempt to preserve lives avoiding mass contagion and the supelotation of the National Health System, this represents an imminent risk of accelerated contamination to the user population. As seen in the images and reports, the use of masks and protective equipment is not seen by everyone and much that they use them, they do so inadequately. In addition, it is worth noting that the neighborhood where the Tabuleiro Market is allocated, ranks fifth among the 50 neighborhoods in the city of Maceió in relation to the number of infected in the entire capital, with 750 registered cases, according to official data from the state government on June 23, 2020.

For the users of the place, the sounds connected to the buying and selling process and coming from the radio of the street market are considered to belong naturally to the street market, inherent to this commercial activity, so that its absence would not characterize it, since the noise of the car horns and especially of the speakers in front of the establishments is considered as an undesirable sound, which hinders the functioning of the street market. For 70% of the users questioned the noise of the street

market does not bother them, although most agree with this statement their motives are different, being influenced by their economic relations, financial survival and belonging to the commercial core and consumers with their vision of street markets always assume the identity of sound source.

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