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RESEARCH ARTICLE

AIRPORT NOISE POLLUTION - ISSUES TO BE DISCUSSED

***Truong Quang Dung**

PhD. in Economics, Ho Chi Minh City University of Technology (Hutech), Vietnam

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ABSTRACT

The impact from airport noise on staff and surrounding communities has been demonstrated. Many countries have authorized different measure ranging from regulating aircraft technical and airport safety or maintaining monitor right of directly affected community. In Vietnam, apart from ICAO standards and airport safety regulations, people do not have the means to monitor and present their opinions to the aeronautical authorities. Tan Son Nhat Airport, which exists in the heart of the city, has the largest noise impact on the surrounding communities. However, the only step to tackle the problem now is making noise map. This article is aimed to figure out the necessity of community involvement in monitoring the impact of airport noise.

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INTRODUCTION

Noise definition

Noise can be defined as unwanted sound that can cause annoyance, sleep disturbance, speech interference, distraction and at extreme levels, noise can lead to health related issues such as hearing loss (CANSO, 2015). International Civil Aviation Organization (ICAO) defines noise is the unwanted sound. At the airport, noise is unwanted sounds caused by the aviation operating process (FAA, 2017). A pleasant sound for this person can be uncomfortable noise for others. It is difficult to identify anything noisy or annoying for the whole community. The extremely complex human response to noise makes evaluating noise impacts a challenging task (Noisequest, 2017). People are able to hear sound from 16 to 20,000 Hz. However, that frequency varies with age and other factors. There are many different physical unit systems can be used to measure the intensity of the sound, but the most commonly used is the decibel scale set up by Alfred Bell. The 10th decimal of (dB) is Bel. The weakest sound intensity that a human ear can hear is 1 dB (Chu Hoang Ha *et al*., 2009).

The impact of noise pollution

About 22% of people say that they often find it difficult to sleep because of airport noise. In the high noise exposure level areas, 50% of the population complains about noise. Workers who are directly exposed to jet noise in a duration have rapidly suffered from hearing loss. Noise can cause dizziness, earache or occasionally ruptured eardrums. The maximum noise level that does not harm the communication is less than 55 dB. The noise level of 70 dB has been a very noisy condition, which has a negative effect on public communication. The productivity is affect if noise level is above 90 dB. Some experiments also found that the inefficient work also occurred at lower noise levels. In addition, noise can be mechanically disturbed, such as disturbing communication, physically bothering the body, mainly for the auditory and nervous systems, disturbing the social activities of man. All of these disturbances eventually lead to bad manifestations of the psychological, physiological, pathological or productivity then affect life quality.

The cause of noise

Noise results from 2 types of factors: aeronautic and non-aeronautic factor. The noise which is directly caused by the airplane is a type of aeronautic factor, which cause the most significant impact. The noise caused by the airplane mostly comes from the engine. Some other parts of the airplane also cause the noise which are wing flaps, the landing gear, and parts belonging to wing. The noise caused by the jet is much more intense than propeller aircraft, of which peak is extremely high. This volume of the noise is the largest when the plane takes off, speeds up or flies higher. Supersonic aircraft which flies at 12 meters above may cause maximum pressure to the ground at 100N/m^2 (127 dB). This will cause damages to residential assets, and troubles to other people.

****Corresponding author:*** **Truong Quang Dung,**
PhD. in Economics, Ho Chi Minh City University of Technology (Hutech), Vietnam.

Passive aircraft noise is the noise at the ground when a plane flies through. Residents living at the area that plane flying through will be suffered. The noise around the airport tends to increase to the direction of the take-off runway and landing runway in terms of parallel and perpendicular direction. There are two parameters used to evaluate the noise, which are: (1)L_{Aeq} , dB_A - The level of the sound of the plane when flying through survey point; (2) L_{Amax}, dB_A – Maximum level of the plane when flying through survey point. The other part of the noise comes from the non-aeronautic activities. They includes: the noise from building construction, the noise from the traffic (vehicles coming in and out of the airport, vehicles inside the airport,..), the noise from industrial activities (manufacturing activities and service providing activities in the airport) and the noise from entertainment activities.

MATERIALS AND METHODS

Airport noise data was collected from noise measurements at Tan Son Nhat International Airport (Chu Hoang Ha *et al*., 2009). Data noise included internal flight zone of Tan Son Nhat International Airport and external flight zone of Tan Son Nhat International Airport. The area in internal flight zone of Son Nhat International Airport is an area with airplanes landing and takeoff, taxi run, ramp, parking. The noise data in this area is measured at 10 points with the specific position of aviation activity (Table 1). The area in external flight zone of Son Nhat International Airport is an area without airplanes landing and takeoff, taxi run, ramp, parking. This area is the area where the flight activities such as terminal, the parking lot of the means of transport take place; the area may be affected residential activities by aviation activities. Noise data in this area is measured at 20 points from the center of the runway of the aircraft (Table 2).

RESULTS AND DISCUSSION

Results of noise evaluation

The noise measurement at Tan Son Nhat International Airport showed that, take off and landing is the highest noise exposure level areas. Equivalent Continuous Level (LAeq), Maximum Continuous level (LAmax), Noise exposure levels at the 1: 1 octane frequency all exceeds the prescribed standards for the labor sector and is particularly far beyond the standard for residential noise. Meanwhile, both areas are densely inhabited and in long-term professional deafness is expected to happen with the communities living in these areas. Further from the central of landing and taking off path, the noise exposure level decreases significantly. However, at the time of landing and taking off, the noise exposure level still exceeds the standard. The area is place of some military camp hence the impact on the solider is obvious. Audience research of Noi Bai International Airport staffs showed that 64% of tinnitus sufferers, 58% had headaches, 37% had dizziness, 37% had insomnia, and hearing ability reduced proportionally to the intensity and duration of exposure (Nguyen Thanh Quan, 2011).

Experience on airport community involvement in airport noise monitoring and management

Experience in the United States has shown that many states require state's cities to incorporate noise into their overall planning, detailing land planning to minimize the impact of noise on the community. Traffic developers, especially roads and airports, must listen to public opinion and sound scientists before finalizing the system design. The Federal Aviation Administration (FAA) has a program of quarantining thousands of homes around major airports (Tien Phong newspaper, 2012). The FAA also set up a website that provides all airport noise information. The website also guides people on how to identify noise types, how noise pollution levels assessed, and how to report pollution levels to authorities. This is an open and direct portal that helps people engage in the process (FAA, 2017). The airports must have a noise and other environmental factors monitoring committee established by the surrounded residents. For example, the US state of Florida, the Citizen's Committee on Airport Noise was established considering potential noise reduction methods and proposing programs, concepts and resolving complaints. The airport noise monitoring committee will focus on surveying the public about noise levels at Palm Beach International Airport and recommending noise reduction measures (Palm Beach County, 2010). Other developing countries, such as Canada, France, Finland and the Netherlands, also have similar organization for noise monitoring at the airport. Asensio *et al*. (2014) evaluates Noise Insulation Programs (NIPs) in Spain show that people are aware of the benefits of the program but still find that aircraft noise is a major source of disturbance. Previously, the NIPs were implemented by building an airport noise map to test the established noise reduction measures. This program will be managed by a council comprising the Regional Government, the Ministry of Environment, Rural and Marine Affairs and the City Council (Asensio *et al*., 2014).

The management and monitoring of noise at Vietnamese airports

Tan Son Nhat airport locating at the center of Ho Chi Minh city, which is the biggest airport of Vietnam, welcomes about 400 flights per day (Tuoi tre newspaper, 2012). It is surrounded by hundreds of household. Landing and takeoff activities may cause significant impact to residents' normal life; however, it was only managed by noise map without pointing out the specific solutions to minimize the noise. The residents are not able to access to documents that evaluating the noise and official information channel or official representative office to follow the level of impact of the noise to their life. All of the standards related to noise at the airport are managed by The ministry of Resources and Environment, include: National technical standards about the environment in accordance with National technical standards about noises (Ministry of Natural Resources and Environment, 2010) and the penalties for administrative violations in protecting the environments (Vietnamese Government, 2013). Airplanes which are operating in Vietnam must have the noise certificate provided by the Civil Aviation Authority of Vietnam (CAAV). Aircraft engine operating in Vietnam must comply with the requirements about engine exhaust regulated by ICAO. Airport building investors are required to build the noise map and to release and implement the solutions to minimize the noise, establish the appropriate traffic route inside the airport to minimize the operating distance of the vehicles; prevent solid waste, hazardous waste; cope with environmental accidents happening at the airport, runway (CAAV, 2013). Unlike other airports in the world, Vietnamese airports have not been directly supervised by the residents yet via any offices.

Table 1. The results of noise measurementsinternal flight zone of Tan Son Nhat International Airport

Area	Laeq	Lamax	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
Number 1 (10° 48' 37'' N, 106° 38' 03'' E)										
Mean	74.9	85.5	77.7	76.0	73.2	70.7	67.5	65.5	61.4	52.9
Min	64.2	69.5	67.3	58.2	58.0	53.1	48.9	49.6	45.6	43.2
Max	83.3	99.3	87.6	91.0	88.0	85.8	83.6	83.4	79.9	69.3
Number2 (10 48 41 N, 106 38 45 E)										
Mean	71.8	82.7	73.8	74.5	72.4	72.0	67.1	67.5	66.4	60.2
Min	57.8	62.1	57.3	53.7	51.0	47.7	40.7	48.3	46.4	31.5
Max	81.4	99.0	85.3	86.1	95.5	90.5	86.6	89.2	86.9	84.6
Number3 (10 49 10 N, 106 40 02 E)										
Mean	76.3	85.9	78.9	80.3	78.1	76.2	74.1	68.3	69.5	64.9
Min	55.6	58.6	52.0	52.1	51.6	43.3	49.1	39.5	43.1	41.6
Max	88.3	112.0	103.1	107.2	104.5	109.8	100.3	100.9	98.3	95.2
Number 4 (10 49 17 N, 106 40 13 E)										
Mean	76.7	89.0	85.5	83.6	75.8	74.5	72.8	73.9	72.1	64.4
Min	55.3	57.5	54.1	46.1	42.3	44.8	48.1	49.3	52.5	45.3
Max	88.1	104.2	102.3	101.1	100.8	100.0	95.8	96.6	92.5	77.6
Number5 (10 49 36 N, 106 40 39 E)										
Mean	67.8	77.0	69.7	69.3	63.6	61.9	60.6	59.0	57.0	51.4
Min	59.4	67.0	58.2	59.3	53.8	42.9	48.9	47.0	43.5	42.1
Max	72.1	89.8	74.7	87.2	84.2	79.9	78.6	72.7	74.5	68.1
Number 6 (10 49 29 N, 106 39 25 E)										
Mean	67.2	74.3	72.2	65.2	56.8	57.6	56.2	55.2	57.5	47.8
Min	55.3	55.8	54.7	45.7	36.8	31.2	27.5	30.3	48.3	42.8
Max	76.7	89.5	88.5	82.0	74.0	81.8	75.2	70.0	74.6	53.7
Number 7 (10 49 35 N, 106 39 32 E)										
Mean	68.1	78.8	73.2	66.8	55.6	58.8	57.9	56.4	58.9	52.2
Min	55.4	58.8	54.9	45.5	36.5	30.4	27.2	30.5	52.3	42.6
Max	87.5	103.1	100.6	96.6	73.3	86.2	86.8	79.5	77.0	60.6
Number 8 (10 48 37 N, 106 38 03 E)										
Mean	65.9	72.7	66.0	58.3	59.8	54.5	52.4	51.3	54.6	48.8
Min	58.1	60.7	56.2	2.0	43.1	41.7	32.7	32.2	48.0	45.3
Max	75.2	85.8	83.0	75.9	78.7	75.0	72.9	64.7	59.4	52.8
Number 9 (10 49 47 N, 106 39 32 E)										
Mean	65.0	74.3	68.2	66.1	60.2	58.6	58.5	56.5	57.6	49.4
Min	48.8	58.0	41.2	47.9	41.9	32.1	29.6	34.1	52.4	42.0
Max	82.2	88.5	93.1	83.0	78.8	83.6	83.2	75.5	69.7	54.8
Number 10 (10 48 57 N, 106 39 34 E)										
Mean	78.7	87.0	77.9	76.3	77.6	76.1	72.1	71.5	69.9	64.0
Min	63.5	69.8	65.6	60.8	58.9	57.2	55.0	50.9	44.6	42.3
Max	86.1	94.0	92.5	85.1	92.9	85.6	82.1	80.2	79.4	75.0

Source: Chu Hoang Haet al.(2009)

Table 2. The results of noise measurements external flight zone of Tan Son Nhat International Airport

Area	Laeq	Lamax	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
Number 1 (10 49 40 N, 106 40 57 E)										
Mean	58.6	74.0	49.6	51.3	48.2	53.2	56.1	61.8	52.7	44.1
Number 2 (10 49 53 N, 106 39 44 E)										
Mean	63.3	80.1	57.5	66.7	70.6	66.6	62.4	61.8	50.8	45.8
Number 3 (10 48 19 N, 106 38 22 E)										
Mean	70.8	88.2	49.0	60.0	57.1	58.2	59.8	61.3	56.8	44.1
Number 4 (10 48 52 N, 106 38 45 E)										
Mean	72.6	88.1	48.9	56.7	60.7	62.6	62.2	61.8	54.0	45.5
Number 5 (10 48 23N, 106 39 28E)										
Mean	82.6	90.9	81.3	79.9	81.5	80.2	75.5	74.0	72.9	58.9
Number 6 (10 48 53 N, 106 40 03 E)										
Mean	61.6	78.6	46.5	51.3	44.2	51.3	54.6	58.1	52.2	45.1
Number 7 (10 49 20 N, 106 40 44 E)										
Mean	62.4	79.0	46.8	47.1	44.5	48.2	49.9	56.2	52.1	43.6
Number 8 (10 50 08 N, 106 39 39 E)										
Mean	68.7	82.4	61.5	65.3	69.7	74.6	74.4	75.3	60.5	52.9
Number 9 (10 50 12 N, 106 39 23 E)										
Mean	70.5	84.5	57.5	60.8	62.7	73.8	70.4	64.6	56.8	51.5
Number 10 (10 50 17 N, 106 38 49 E)										
Mean	60.8	80.2	54.6	58.9	59.8	59.8	61.3	64.8	56.7	46.8
Number11 (10 49 39 N, 106 38 28 E)										
Mean	70.9	87.8	48.2	57.4	61.1	62.9	64.9	64.3	59.7	46.4
Number12 (10 49 16 N, 106 38 19 E)										
Mean	67.7	82.5	49.9	58.7	60.4	57.3	63.8	70.0	57.4	44.3
Number13 (10 48 39 N, 106 37 49 E)										
Mean	71.4	86.1	47.0	55.9	56.2	56.6	61.7	64.6	55.4	45.3
Number 14 (10 48 10 N, 106 39 33 E)										
Mean	58.8	73.3	45.3	54.6	47.5	58.1	61.4	60.5	56.7	47.2
Number 15 (10 48 17 N, 106 39 52 E)										
Mean	65.2	83.2	48.3	49.3	46.9	48.5	48.5	53.4	52.4	45.0
Number 16 (10 48 25 N, 106 40 06 E)										
Mean	68.5	88.0	47.2	52.9	50.0	53.3	55.9	57.9	57.2	45.3
Number 17 (10 48 50 N, 106 40 33 E)										
Mean	66.5	78.7	54.7	59.8	63.5	69.9	71.9	61.4	55.7	48.3
Number 18 (10 48 57 N, 106 40 57 E)										
Mean	60.2	79.4	47.7	49.7	44.0	49.3	54.8	61.6	54.4	44.9
Number 19 (10 50 12 N, 106 40 31 E)										
Mean	68.5	84.8	55.4	60.0	63.2	59.7	69.5	64.2	55.2	49.6
Number 20 (10 49 06 N, 106 37 60 E)										
Mean	71.8	89.0	48.2	54.9	59.3	59.3	62.0	64.6	55.4	43.3

*Source:*Chu Hoang Ha et al.(2009).

And actually, there is still no popular informative channel to transfer the information about noise pollution to residents living around that area. In other countries, the design and building of the airport is planning around the area that limits the residents to building houses to minimize the noise pollution by landing and takeoff and other activities from the airport. In Vietnam, in re-planning the airports, the administrative offices only establish standards for noise minimizing outside the airport fences to ensure the safety for flying activities. Therefore, the licensing for building civil works only restricts the maximum the height, not the safe distance to minimize the noise for residence. That is, the current regulations have not yet focused on protecting the residents from airport noise, but it only focused on safe operating for the port operators. July 2017, CAAV signed a memorandum of understanding (MOU) on technical cooperation in the field of aircraft noise monitoring for airports and airfields with Japan's RION. MOU contains the content of the pilot program to design a noise monitoring system; develop a manual for the measurement and evaluation of aircraft noise; technical training, in corporate with CAAV, provides training in aircraft noise measurement and measurement. Project duration is from October 2017 to September 2019 (CAAV, 2017). These are the first steps that show the issue of airport noise being noticed in Vietnam. Even so, there is no direct monitoring of the people affected by the noise caused by the airport.

Recommendation

One way to make airport operators more transparent about their responsibility for the environment is the increased engagement of people in airport noise monitoring and management process. The first step is to help people better understand the current noise pollution that they are experiencing by making and publishing annual airport noise assessment reports. Current regulations and monitoring agency documents (CAAV and MONRE) should be widely publicized. In addition, aviation authorities also need to issue notification procedures and introduce those documents, providing people with official information to receive their feedback on the current state of the noise at airport. A deeper level of engagement is the establishment of a monitoring committee with members representing the local people or local authorities where the airport operates. This committee has the right to participate in noise assessment processes and to propose airport noise reduction solutions. The long-term solution is to integrate noise reduction standards and the distance-from-residential to airport standards into the new airport planning process. This process also needs the supervision and approval of residents surrounding the airport through the monitoring committee to ensure noise pollution is managed right from the construction of an airport.

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