A case study on public noise annoyance in relation to research trends on noise pollution

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Summary
Exposure to noise annoyance due to anthropogenic sources together with noise sensitivity of public is on the increase especially in developing countries. In this article, the public noise complaints appealed to a provincial directorate (Antalya) were associated to research trends obtained from bibliometric and content analyzes in the field of noise pollution in Turkey as a case study. According to results of noise annoyance (n=785) in 2014, noise sources mostly complained about are listed as music sound amplifiers (47.6%), mechanical equipment (35.2%), air conditioners (8.2%), electric generators (4.7%) and the others. In the scope of bibliometric and content analysis, studies published in Web of Science and Scopus database were categorized as environmental noise sources. The percentage of studies on traffic noise, industrial plants, mechanical equipment and aircrafts is found as 24%, 13%, 10%, 8%, respectively. Moreover, 48% of these studies focus on sound level measurement and modeling, and approximately %20 of them investigates the noise exposure and annoyance. The other point to be attracted is that it is not necessarily given weight to quiet area concept which is the hot topic for managing noise pollution problems recently in European countries. These results led us to consider not only the importance of information exchange, cooperation and participation of governmental institutions during deciding route of scientific researches but also the necessity of public participation during enforcing and defining priorities in legal regulations especially in solving environmental pollution problems at society level.

Keywords: quiet area - urban design - bibliometric analysis - noise complaints

1. Introduction

The problems start with life and these exist only if there are values and when the values are specified, at that point science starts with those problems [1]. In the modern world, environmental health has become an important value to protect the quality of human life. A survey conducted in the European Union (EU) Member States (MS) yielded "noise" as the most serious indicator for the poor quality of life [2] while ignoring its relative importance compared to air and water pollution. The reason of this situation was attributed to be unawareness of policy makers of the scale of the noise problem whose impacts can be seen in today's world. According to the result of bibliometric review on environmental health literature for a period of 10 years (1995-2005) in Europe, it was stated that the little or no importance were given to noise pollution in the European literature [3]. On the other hand, the survey conducted in Turkish elementary schools to investigate the noise pollution awareness showed that noise is not perceived as an environmental pollution [4]. However, World Health Organization (WHO) states that noise pollution is considered as the second most hazard environmental type of pollution after air and water pollution especially in densely populated areas [5]. In order to achieve successful applications on noise policy, it is needed to integrate and cooperate the knowledge in both scientific area and political authorities with public contribution. Accordingly, this study aims to investigate the public noise complaints received by the local authority (Antalya city) and research trends on noise pollution in Turkey and to understand the whether scientific publications and public complaints on noise pollution goes in parallel or not.

2. Materials and Methods

2.1 Noise Complaints

In this study, noise complaints data received by the Provincial Directorate of Ministry of Environment and Urbanization (pMoEU) in 2014 was evaluated for Antalya, Turkey as a case study. The province with the population of 2.222.562 is located in the Mediterranean Region of Turkey and also the most famous city in relation to tourism. The pMoEU is the responsible local authority for the application of Regulation on Assessment and Management of Environmental Noise (RAMEN) (Official gazette number 2010/27601) which was harmonized with the European Commission Environmental Noise Directive (2002/49/EC). Since the noise complaints received by pMoEU have wide-ranging, they were categorized to evaluate easily. The places complained were classified as the entertainment places (such as disco, bar, restaurants with live music), manufacturing plants (such as printing house and bakeries), residential buildings, construction facilities, workshops, transportation, street weddings and schools. The noise sources of these complained places are categorized as the music sound amplifiers, electric generators, air conditioners, mechanical equipment, human sounds and vehicles. The main limitation of these data in this study is that it includes only data obtained for 2014. However we investigated the scientific studies on noise pollution not only for the year 2014 but also the other years with a range of 1976-2014.

2.2 Bibliometric Analysis of Noise Pollution Researches

Bibliometric analysis is described as the implementation of mathematical and statistical methods to the entire scientific literature, books and documents [6,7]. The advantage of bibliometric data is that they can give information about the authors, published time, publishing document, place, whom they are done with etc [8].
In this study, the information/document on noise pollution were searched from electronic databases Web of Science (WOS) and Scopus which are the most commonly used ones on a very wide variety of scientific research areas for literature searching [9, 10]. This search was limited with the topics specifically as “environmental noise”, “noise pollution” and “quiet areas” and the country was refined as Turkey. The selection of documents were based on firstly their title and abstracts. After reading full of them, the selection was done according to the main aim of this study.

3 Results and Discussions

3.1 Noise Complaints

A total of 785 noise complaints were applied to the local authority in 2014. The noise complaints mostly came from workshops with a percentage of 47%. The entertainment places are the second most complained place which accounts for 35.1% of all noise complaints. This is followed by residential building (6%), street weddings (4.6%), construction (3.5%), manufacturing plants (1.1%),

schools (0.7%) and transportation (0.4%) as seen in Figure 1.

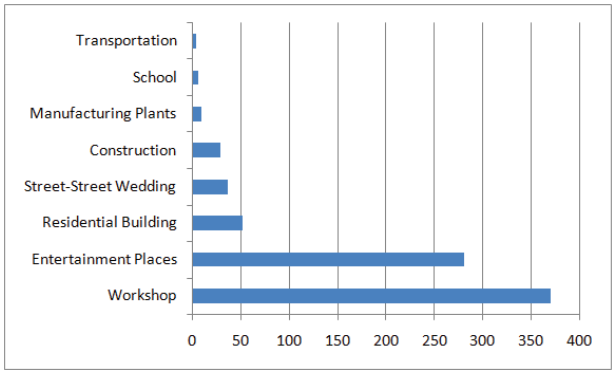

Figure 1: Noise complaint place vs frequency

The noise sources complained from those places were also analyzed. It is found that music sound amplifiers are the most annoyed noise source representing 47.6% of the total number of noise complaints received and mechanic equipment account for 35.2% of all noise complaints. This is followed by the complaints regarding air conditioners (8.2%), electric generators (4.7%), human sounds (2.3%), water booster (1.1%), neighbors (0.4%) and vehicles (0.3%). The number of noise complaints also varies with regard to season. Noise complaint data showed that public seems to be most annoyed at the summer time and 45.8% of the total number of noise complaints was received during the June-August period. At that period, 22% of noise complaints come from music sound amplifiers (Figure 2).

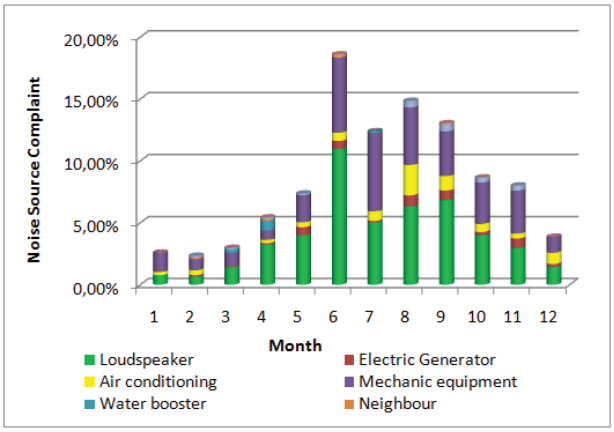

Figure 2: Noise sources complained vs. month

These findings are also consistent with the studies of [11,12,13,14] which states that the modern day people mostly worked in the closed places prefer to rest and relax in the outdoor entertainment places which are generally placed in the city center to be easily accessible. However, people living around these entertainment premises may be disturbed due to their music amplifiers. When considering the weather conditions of Antalya, people generally live their home with open window and noise complaints come from during the night time. It is well known that night time noise exposure leads to health damage due to its impact on sleep disturbance. Related with the night noise, WHO published the "Night Noise Guideline for Europe" in 2009 and according to this guideline, annual average night exposure not exceeding 40 dB outdoors is recommended [15]. In Western Europe, the main burden of environmental noise is the road traffic noise that leads to sleep disturbance and annoyance [16]. Moreover, in the study of [17, 18], traffic noise is indicated to be the main source of annoyance and complaint relative to other sources such as industrial activities [19]. However, in our study, it was found that the transportation noise is the least complained noise source. At that point, it is important to state that the noise complained data used in this search is the data only obtained from pMoEU for one year period. Due to this fact it cannot be said that these results represent whole public noise annoyance for Antalya. In order to define the human reactions to noise, annoyance is one the most widely used and studied effect of noise [20], although there are different methods like conducting questionnaires or collecting information on self-reported health endpoints. Related with the determination of subjective noise annoyance of community, there has been already standardized questionnaire form set by the International standardization Organization (ISO) [21]. Moreover, in the study focusing on published research papers on human reactions in change noise conditions, it was stated that %56 of studied papers considered that the annoyance is the main indicator and the others focused on the reactions such as physiological and psycho social wellbeing, activity disturbance and use of living environment [22].

3.2 Bibliometric Analysis of Noise Pollution Research

Totally 213 records were yielded from the electronic databases WOS and Scopus with the topics on environmental noise, noise pollution and quiet areas. However, it was found that 122 of these documents were related with the selection criteria. The others excluded were mostly related with the computer science and electrical signals. 12 of these studies were obtained only from WOS,

90 of them were only from Scopus and the rest of them were existed at both WOS and Scopus databases. The document type of studies consist of articles as 60%, conference papers as 36%, proceeding paper as 3% and review as 1%.

When evaluating the number of published studies according to the year (Figure 3), it is seen that the researches on noise pollution have been accelerating after the year 2005. It is more related to publication date of the national legislation on environmental noise management which was forced with date of 01.07.2005. This is also supported with the study of [23] whose investigation assumption is that governmental decisions that encourage the environmental programs can be determinant on the improving the academic output. In that study, it was also stated that education financing, publishing of domestic journals and the English language are the necessary factors in scientific productivity in environmental sciences and ecology.

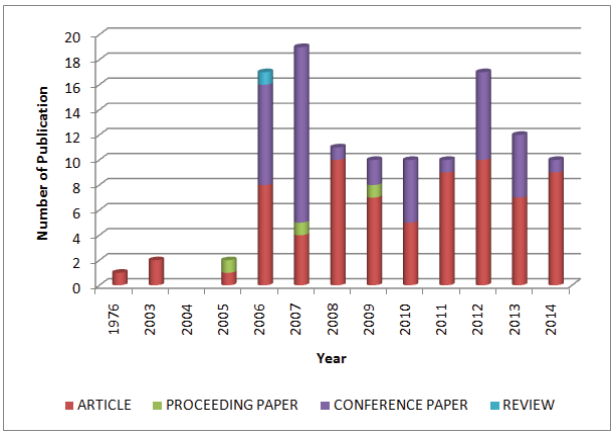

Figure 3: Number of publications on noise pollution through the year

In this research, the studies on noise pollution are classified based on in which area these researches are conducted. The results reveal that noise pollution studies are mostly on transportation with percentage of 39% and industrial manufacturing workshops with the percentage of 17%. It is followed by the percentage of educational institutions, general noise issues, general environmental issues, commercial & leisure places, health institutions, urban environment, building acoustics and laboratory studies as 10%, 7%,7%, 6%, 5%, 4%, 3% and 2% respectively as shown in Figure 4.

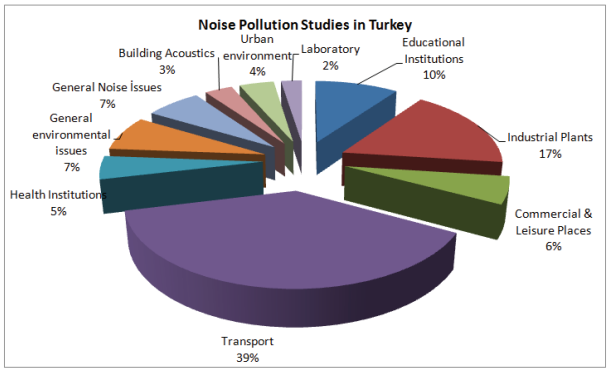

Figure 4: Classification of noise pollution studies in Turkey

When investigating the assessment methods of studies, it is seen that 40% of them focus on the noise measurements and noise mapping to determine especially the noise levels of road traffic, aircrafts and hospital indoor environment. %28 of the studies is related with the noise exposures especially for the workers in mining industry and health institutions and also due to the aircraft noise. %20 of them investigates on noise reduction mostly provided by the urban land planning, building acoustics and improving the public transportation plan. % 12 of them was on environmental awareness. In those researches, it was stated that noise pollution is the least important environmental concern [4, 24, 25]. Although there are lots of evidence regarding the health impacts of environmental noise such as cardiovascular diseases, hearing impairment and sleep disturbance [20, 26], it is the most ignored one among the other pollution types because its effects cannot be seen immediately and they are cumulative or indirect [27]. This leads to insufficiency in noise control [28].

4 Conclusion and Recommendations

Main objective of this study was to investigate the noise complaints data received by the pMoEU in 2014 and to analyze the researches specifically on noise pollution and quiet areas published in electronic databases WOS and Scopus. Therefore, it was aimed to determine whether the research trends on noise pollution issues was in the same direction with public noise complaint trends in the scope of noise sources.

The findings showed that while public mostly complained from the entertainment places due to their music sound amplifiers in Antalya, the researches on environmental noise pollution in Turkey mostly focused on road traffic noise. In order to be more representative for public noise annoyance, it should be conducted public noise annoyance surveys with a standardized questionnaire for a certain period of time, which can also be important to compare the annoyance results with other international studies.

The bibliometric analysis of environmental noise pollution studies published on WOS and Scopus showed that it is not necessarily given importance to "quiet areas" which is the hot topic on environmental noise management recently in European countries. The number of studies recorded for the years 1976-2014 in the scope of this study cannot be said as so high. This result can be explained firstly as the limitation of this search only focusing on the two electronic database WOS and Scopus. Besides, it can also be listed other factors as explained in the literature such as the publication language, curriculum of education, initiatives from government etc.

Moreover, it is seen that the number of the environmental noise researches has been increasing after the year 2005, which is considered more related with date of the national regulation on environmental noise that was focused in 2005 also. It is seen that policies of national and local authorities on environmental noise have an important impact on the scientific studies. When considering this issue, it is recommended to give more importance for providing initiatives to the researches on environmental noise that can analyze the needs of society and their opinions. Therefore, it is thought that the cooperation of governmental sector -which is the policy maker and also have knowledge on society reflection- and the academic area that presents the approaches scientifically to solve and manage the environmental problems systematically.

Acknowledgement

The public noise complaint data was obtained from the Provincial directorate of Environmental and Urbanization, Antalya, Turkey. For recording of this data, we want to thank to Environmental Engineer Özgür Aykan.

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