



Evaluating the Effectiveness of Environmental Noise Management Applications

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ABSTRACT

Environmental noise is one of the indicators becoming important as a means of evaluating urban quality of life, which stimulates governments to develop effective noise policies. The focus of this study is on evaluating the effectiveness of environmental noise policy applications as a case study in Antalya, Turkey facing with environmental challenges due to densely urban and touristic activities. In this scope, mainly three steps were carried out consisting of i) description of noise policy, ii) identification of noise policy instrument, iii) evaluating the effectiveness of policy goals in the context of noise complaint data appealed to local authority up to 2016 and strategic noise map of the city. The findings showed that the policy instrument dominantly used on noise is regulative one, other than economic and communicative instruments. Despite intensive audits by local authorities, the noise complaints have been increasing as 22% in two years. Using only strategic noise map results for action plans may lead deficiency in updating due to time extension and dynamic of acoustic environment. As a conclusion, more effective noise policy instruments are required to achieve an acceptable acoustic quality, with improving more innovative and sustainable approaches through integrated policies such as spatial and urban planning and noise monitoring networks.

Keywords: Noise policy, noise pollution, entertainment noise,

1. INTRODUCTION

In modern world, the characteristic of noise pollution has been starting to evolve with the changes in technological improvements and the cultural norms of community. Therefore, the main difference and the driving force to deal with this problem is that this pollution type has been affecting more people than the past since more people have been living in the cities at present. Hence, the acousticians, environmental scientists, epidemiologists, planners and policymakers have begun to focus on the impacts of noise pollution and the control strategies to prevent the excessive noise levels (1).

In recent years, urban citizens have been demanding the implementation of the culture of acoustic comfort, which leads to public appreciate the peace and quiet. The cities like Antalya which is the most touristic city with its geographical and climatic conditions in Turkey, face with the environmental challenges due to dense urban activities and, they need to be solved for the sustainability of urban life quality. One of the environmental challenges to overcome in Antalya city is the noise pollution.

In this study, we mainly focus on the effectiveness of environmental noise management applications in Antalya, Turkey in the scope of goals defined in national regulation on noise management. Moreover, based on the existing situation, it is attempted to make recommendations to the related authorities for improving the acoustic environment.

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2. METHODOLOGY

2.1 Study Area

As a full candidate country of European Union (EU), Turkey has been starting to harmonize EU directives into its national legislations. In this extent, Environmental Noise Directive (END) (2002/49/EC) was one of the first directive harmonized in the scope of environmental management. Since the legal and policy frameworks at the national level are applied through the local authorities in most of the countries, we selected Antalya City as a pilot area for this study. It is one of the most important cities in Turkey facing with the difficulties during applications of END due to its dynamic characteristic coming from its touristic and densely urbanized properties.

The population of Antalya is given as 2.222.562 for the year 2014 and approximately 10 million tourists come to this city in each year (2). Because of the climatic conditions of the city, people live their home generally with open window, therefore the environmental sounds coming from the roads, railways and commercial firms like entertainment places etc. also reaches their home easily. All this situations effects the acoustic quality of the city.

2.2 Methodology

In order to evaluate the effectiveness of environmental noise management applications in Antalya, it was benefited the main idea of methodology proposed by Weber et al. (2013) (3). That methodology includes mainly four parts which are (i) the description of noise policy in terms of cause and effect; (ii) identification of noise policy instruments; (iii) analyzing the goal attainment; (iv) evaluating the effectiveness. In this study, the national environmental noise policy in Turkey and its main goals are described. Based on the main goals defined in the policy, the attainment of these goals and the effectiveness of the applications are discussed with regard to strategic noise maps and noise annoyance level based on the noise complaint data appealed to local authority as provincial Directorate of Ministry of Environment and Urbanization (pMoEU) in Antalya.

3. EVALUATING THE ENVIRONMENTAL NOISE POLICY

3.1 Description of Noise Policy

With the increase of population and their mobility, the environmental noise and its impacts on health have also been increasing. The newly published report on noise in Europe 2014 states that nearly 125 million people are exposed to noise levels greater than 55 dB(A) L_{den} (day evening night sound level) due to road traffic which has been determined as the major environmental noise pollution source (4,5). Related to health effects of exposure to noise, there are lots of scientific researches and published reports. One of them was published by World Health Organization (WHO) on "Night Noise Guidelines" which may be considered as an extension to as well as an update of the previous WHO *Guidelines for community noise* (1999) (6,7). Besides, European Environment Agency (EEA) was prepared the good practice guide on noise exposure and potential health effects, which was intended to assist policymakers, competent authorities and policy makers in understanding and fulfilling the requirement of END (8). According to report based on the second round of noise mapping data, the health implications of environmental noise in 33 European countries (EU28 countries plus Norway, Turkey, Switzerland, Iceland and Liechtenstein) is described as the number of adults with (severe) annoyance and (severe) sleep disturbance, as the number of children with reading impairment attributable to noise and the number of residents with hypertension, hospital admissions due to cardiovascular disease and the occurrence of premature mortality. It is found that almost 90% of the health impact is related to road traffic noise exposure (9). Thus, , it is apparent that it must be needed to develop management and control strategies for the noise pollution when considering the items aforementioned.

3.1.1 Environmental Noise Policy in Turkey

In Turkey, the environmental noise policy was firstly and basically mentioned with Environmental Law in 1983. Depended on this law, the special regulation on environmental noise control entered into force in 1986. However until 2005, it is difficult to see the application of this

legislation. For that period, as it is proved in literature, noise pollution is the most ignored one among other environmental pollution types mostly named as “forgotten pollutant” and is considered as the least important environmental concern for the community from governmental and educational area although it is scientifically proved that the environmental noise exposure leads to harmful health effect (10-12). This is mostly related with the fact that noise effect cannot be seen immediately and they are cumulative or indirect (13), which leads to insufficiency in noise control (14). In recent years, this situation has become to change both in society level and governmental level through the amended legislation on noise in 2005, which is the Regulation on Assessment and Management of Environmental Noise (RAMEN) included the transposition of END (2002/49/EC). Due to the problems and insufficiencies faced with during the implementation of this regulation by the responsible authorities, it was amended/revised in 2008, 2010, 2011 and lastly in 2015 in order to make the legislation more applicable.

The main aim of RAMEN is to prevent and reduce the harmful health effects due to noise exposures through determination of common approaches for developing the required noise control applications. In order to attain this goal, the strategic noise maps and action plans for the defined noise sources should be prepared. Moreover, the acoustic reports or environmental noise assessment reports is required to be prepared for the specific noise sources. The regulation mainly includes the section as competent authorities, noise emission levels of noise sources, noise and vibration immission levels at the receptors, noise criteria in planning phase, time table and assessment criteria for strategic noise maps, action plans and expertise, dissemination of information to the public and evaluation of the noise complaints (15). Briefly, the main goal of this regulation is to reduce the noise pollution levels through the action plans to be prepared depending on the results of noise maps and to decrease the number of annoyed people. Therefore, we mainly focused on the strategic noise maps and the noise annoyance levels based on the noise complaint data of the year 2014-2015 for Antalya City in order to evaluate the effectiveness of noise policy.

3.1.2 Strategic Noise Maps in Turkey

According to RAMEN, for the first round of noise mapping (until 2016), the strategic noise maps are required to be prepared for agglomeration with more than 250000 inhabitants, for major roads with more than 6 million vehicle passages in a year, for railways with more than 60000 train passages in a year and for major airports with more than 50000 movements within the territories. The extent of the first phase of noise mapping and the responsible authorities are given in Table 1 (16). As seen in Table 1, there are eleven agglomerations. The population of seven of them is above 1 million. As an example, İstanbul has over 18 million population and Ankara has nearly 4 million inhabitants. Moreover, Antalya City, the pilot area of this study, has also over 2 million inhabitants.

Table 1 – The extent of first phase strategic noise maps in Turkey (16)

Noise Source	Extent	Completed Part	Responsible Authority
Agglomerations	11 provinces	4 provinces	Municipalities
Major Roads	2221,6 (km)	600 (km)	Ministry of Transport
Major Railways	254,7 (km)	No information	Ministry of Transport
Major Airports	5	5	Ministry of Transport

3.1.3 Noise Annoyance in Antalya City

The study focusing on the published research papers related with human reactions in changing noise conditions stated that the annoyance is the main indicator representing the human reactions (17). With the increasing rate of urbanization and densely touristic activities in Antalya, the inhabitants of this city mostly face with the noise pollution problem. They convey their annoyance to pMoEU in order to make the complained facilities control by the local authority.

The pMoEU which is the main responsible authority to implement the requirements of RAMEN actualize the audits intensively to lower the noise annoyance of the residents. According to noise data

in 2014, a total of 785 noise complaints were applied to local authority. When these complaints are classified based on their noise sources, it was found that music sound amplifiers are the most annoyed noise source representing 47% of the total number of complaints received and mechanical equipments accounts for 37% of all complaints. This is followed by air conditioners (8%) electric generators 5% and neighbours (2%). Therefore, based on these data, the entertainment places are the most important noise source to be dealt within the scope of noise control applications for Antalya City. For the year 2015, a total of 962 noise complaints were applied to pMoEU. %53 of the noise complaints are again from the entertainment places. It is followed by % 24 of mechanical equipments, air conditioners (13 %), electric generators (9%) and neighbours (2%) (Figure 1).

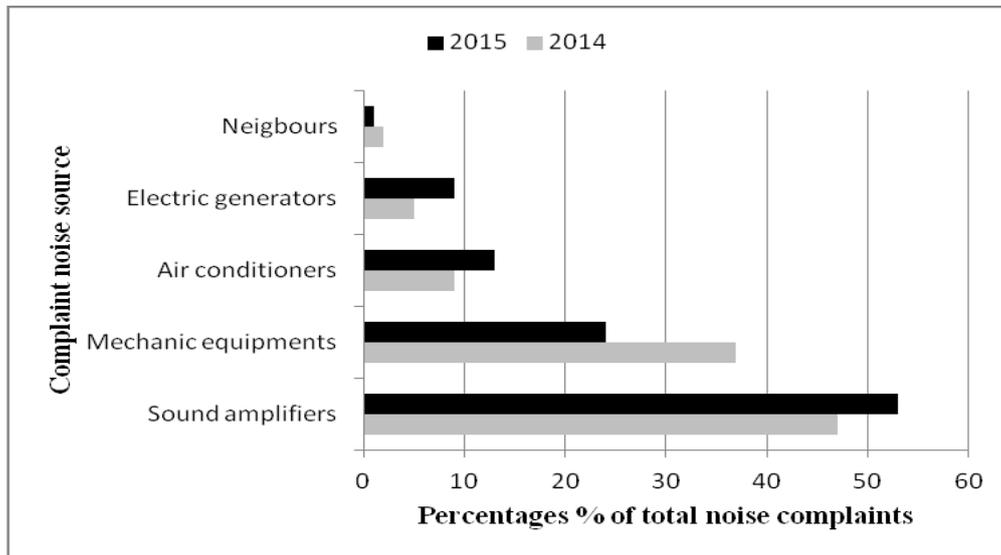


Figure 1 – Noise complaint data based on noise sources in Antalya

3.2 Identification of Noise Policy Instruments

In this part of the study, it is provided the noise policy instruments especially on the noise sources mostly complained. Therefore, as it is mentioned in section 3.1.3, the entertainment places are the most annoyed noise source in Antalya. This finding is in coherent with the studies (18-20) which states that the modern day people mostly worked in the closed places prefer to be relax in the outdoor entertainment places which are generally placed in the city center to be easily accessible. However the residents living near to these facilities are mostly disturbed due to their music amplifiers since people mostly live in their homes with open window when considering the climate conditions of Antalya. In order to prevent and reduce the noise coming from the entertainment places, these premises have to take music allowance from municipality according to both RAMEN and also the Regulation on Establishing and Working License for Facilities. In order to this allowance, they need to be prepared the environmental noise assessment reports after taking the working license and these reports should be approved by the pMoEU or by the authorized municipality. Between the years 2010-2015, approximately 800 reports of entertainment places were examined by pMoEU (21). Therefore, this is the regulative instrument. If the entertainment places are not obeying the rules or they exceeds the noise limit values according to RAMEN, the local authority applies the monetary penalty to the operator of these places based on the polluter pays principle. For Antalya City, due to the exceedence of noise levels determined during the audits by pMoEU, the penalties were applied approximately as 300000 Euros in 2015 (21). This can be given as an example to economic instrument.

In the scope of the communicative policy instruments, noise monitoring systems may be used. However, there is no such a system in Antalya. These systems can enable the related public institutions to potential improvements on acoustic environment and public awareness which is very key element for the political and societal aspect. With such a network, the clear, transparent and independent information can be conveyed to the citizens on the current status of acoustic environment and also to convey the noise monitoring data to the owners of entertainment places in the extent of noise limit values in legislation. Therefore, it is provided the auto control of the entertainment places themselves.

This can reduce both the official audits which are generally finalized with the legal punishments and public complaints due to being aware of the existence of such a system.

Briefly, the regulative policy instruments are mostly used in Turkish noise policy and economic instruments take place only in the scope of polluter pays principle. However, the communicative instruments are lacking during the implementation of the noise policy.

3.3 Analysis of Goal Attainment in Noise Policy

Goal attainment is defined as the state of the target variables relative to the policy goals defined in the regulations (3). The main goal of noise policy has already been defined as to reduce the noise pollution levels through the action plans to be prepared depending on the results of noise maps and to decrease the number of annoyed people. In this study, the target variable is the noise pollution levels and noise annoyance levels. However, since the deadline for the strategic noise maps is defined as the June 2016 in RAMEN, the responsible authorities have been going on working to complete the noise maps. Therefore, there is no action plans based on these maps so it could not be evaluated the change in noise levels. Thus, in this part we evaluated the completeness of the strategic noise maps by the competent authorities. As other target variable noise annoyance levels were assessed in the scope of the noise complaint data.

3.3.1 Goal Attainment in the Scope of Strategic Noise Maps

According to RAMEN, competent authorities are required to complete the strategic noise maps until 2016. As it is given in Table 1, major airports were all completed their strategic noise maps. Moreover, for the second round of noise maps, 15 airports prepared the noise maps and the noise maps for 26 airports will have been completed in 2018. In addition to this, %27 of major roads maps have been completed. Regarding to agglomerations, totally 64 provinces is required to be mapped. 23 of them completed the noise maps. The strategic noise maps of 15 provinces were prepared through EU Project on “Implementation Capacity for Environmental Noise Directive” newly completed at the end of the year 2015 by the Ministry of Environment and Urbanization under IPA 2009 Programme with 6.18 million euro budget that includes technical support and procurement. Eleven provinces are under the first round of noise mapping. Hence, three provinces as Antalya, Malatya and Konya has already completed their noise maps for agglomerations. For the other 8 provinces and the major transports, the studies have been going on by the competent authorities (16).

The strategic noise map of Antalya was completed in 2012. In the scope of this map, totally 307 km² was studied. This includes 320 km of roads, 20 km of railways, 1 port and 1 industrial site and 623 entertainment places. The number of residents exposed to the noise level of sources is also given in Table 2.

Table 2– Strategic noise map results for Antalya agglomeration (22)

Noise Level (dB)	Number of Exposed Residents due to the Noise Sources			
	Roads	Railways	Entertainment Places	Port and Small Industrial site
50-54	100400	5600	16300	600
55-59	65300	4000	6700	200
60-65	44100	1100	3200	0
66-69	32300	0	1500	0
70-74	23600	0	800	0
>75	17400	0	700	0

3.3.2 Goal Attainment in the Scope of Noise Annoyance

According to data of pMoEU, while a total of 785 complaints were appealed to local authority in 2014, this number increased to 962 and the most annoyed noise source is entertainment places. When compared the years 2014 and 2015, it is seen that the noise complaints have been increasing as 22% despite intensive audits by local authorities. The main reason of this situation can be explained with the urban planning and the regulations that are not supportive to each other. Regarding to entertainment places, there are not specified areas defined for those premises in spatial planning. Therefore, they are mostly located inside residential areas and there is no strict restriction during taking the working permission licence. Moreover, Table 2 shows that the number of inhabitants exposed to road traffic noise is the highest and the most secondly affecting noise source is entertainment places. However, there is no scientifically representative study for Antalya whether the residents are annoyed due to traffic noise or not. Therefore, it is important to make extensive social survey to determine this issue. Moreover, it is needed to prepare effective action plans in order to reduce the number of exposed people when considering the severe health effects of noise pollution.

4. EVALUATION OF THE EFFECTIVENESS OF ENVIRONMENTAL NOISE POLICY

As a full candidate country of EU, Turkey has been making significant progress on harmonizing the EC directives into its national legislation. END (2002/49/EC) is one of the first directives transposed in the scope of environmental management. In order to improve the institutional and technical capacity, mainly two EU projects were completed by MoEU. In the scope of these projects, strategic noise maps of some noise sources were prepared. For Antalya City, the entertainment noise was studied as pilot study in newly completed EU project.

Regarding to the strategic noise map for agglomeration in Antalya, the Municipality completed its noise map in 2012 with their own budget and this map was approved by the Ministry in 2015. Therefore, Municipality has newly started to prepare action plans. At that point, they may face with the problem related with the updating information of noise map results. With considering the dynamic structure of Antalya City, there have been changes both in road traffic volume and also in entertainment places since the preparation of that noise map. In this extent, the more dynamic mechanisms may be applied in determination of the noise levels. The noise monitoring systems that are already used in some of EU countries (23,24) may also be applicable for Antalya City. They can give precise, transparent and independent information in a given site on noise variations over time. When considering the increasing rate of noise complaints in Antalya, it is seen that the only regulative instruments on noise policy applications are not enough. Therefore, especially for the interactive complaint management, noise monitoring network can be useful to provide clear information on the current status of and changes in the acoustic environment. It can be considered as a communicative tool to help the public authorities during the implementation their noise pollution prevention policies.

The other most important thing to be considered in environmental noise management in Antalya is that during the urban planning phase and work permission certificate for the facilities, the noise should also be taken into account more effectively. It is thought that such an application will reduce the noise complaints. In recent years, the literature on environmental policy integration also has also focused onto spatial planning with consideration of environmental noise policy (25-27). According to RAMEN, there is already an article stating that the Municipalities must apply the noise exposure categories at the preparation phase of Master Plan and Implementation Plan. Moreover, the noise maps and action plans must be used as the appendix of urban plans. However, it is expected to see this application in next years since the noise map of Antalya has newly approved.

With applying the action plans, it is mainly aimed to reduce the noise levels and the number of exposed people through taking the technical strategies and protecting the quiet areas. However, reduction in noise levels does not always provide more pleasant environment and increase in life quality of human beings (28,29). Thus, it is clear that the newly developed and complementary approaches are needed. Therefore, soundscape approach has become to take place in environmental noise control in last decades (30). However, in Turkey, there are very limited scientific researches on both “quiet areas” and “soundscape” (31-33). To sum up, such studies should be encouraged in both academic and policymakers level for more effective noise policy

5. RECOMMENDATIONS AND CONCLUSIONS

In this study, the environmental noise policy applications were generally given and the effectiveness of these was evaluated in Antalya City of Turkey. Considering the existing situation, it is seen that;

- Noise policy applications are mostly rely on the regulative instruments in Turkey. The regulations affecting the acoustic quality should be support each other.
- In addition to regulative policy instrument, noise monitoring systems may be used as communicative tool especially for peaceful acoustic environment in complaint management in Antalya.
- Regarding to first round of mapping, the provinces has made significant progress through EU Projects and also encouragement and funding of MoEU. This approach should also be carried on in preparation of action plans.
- “Noise” issue should be taken into account and be prioritized especially during spatial planning phase by Municipalities.
- Researches on “quiet areas” and “soundscapes” should be encouraged for sustainable acoustic environment.

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