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A Global Perspective on Urban Environmental Problems in Developing Countries: The Case of Turkey

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Abstract**—**Cities play a vital role in the social fabric of countries and in national and regional economic growth worldwide; however, the environmental effects of such growth need to be assessed and managed better. The critical and most immediate problems faced by cities of developing countries are the health impacts of urban pollution that derive from inadequate water, sanitation, drainage and solid waste services, poor urban and industrial waste management, and air pollution. As globalization continues, earth's natural processes transform local problems into international issues. The aim of this study is to provide a broad overview of the pollution from urban wastes and emissions in Turkey which is a developing country. It is aimed to underline the significance of reorganizing the institutional tools in a worldwide perspective in order to generate coherent solutions to urban problems, and to enhance urban quality.

Keywords**—**Environmental pollution, developing countries, environmental degradation, urban environmental problems.

I. Introduction

THE most critical urban environmental concerns in developing countries such as Turkey include problems related to access to basic environmental infrastructure and services, pollution from urban wastes and emissions, loss or destruction of natural and cultural resources, and exposure of urban populations to natural and man-made hazards. Increasing levels of air pollution, water pollution, inadequate solid waste management and noise pollution are all associated with urban environmental problems. These problems are caused in large part by lack of public and political awareness, inadequate governance, inefficient and inadequate economic and regulatory policies, and insufficient knowledge and information [9], [13], [14].

Turkey is a developing country in which 78.7 million people are living with quite different socioeconomic and demographic features and dietary habits. Turkey has been affected by urbanization like other developing countries since its very first years of development, with a rate increasing from 18.5% in 1950 to about 92% in 2015. Cities with already inadequate infrastructure facilities have to face congested population problems coupled with illegal settlements due to migration from the small settlement units to the large metropolises.

The purpose of this study is to provide a broad overview of the recent patterns and trends of urbanization in Turkey. The dynamics of urban environmental problems and causes are outlined. It is targeted to emphasize the importance of reorganizing the institutional tools in a wide-angled perspective in order to generate coherent solutions to sustainable environmental management.

II. Solid and Hazardous Wastes

The progression of modern civilisation and associated continuous worldwide increase in population contribute significantly to increase in the quantity and variety of waste generated [31]. The ever-increasing consumption of resources results in huge amounts of solid wastes from industrial and domestic activities, which pose significant threats to human health [7]. Continuing advancement in science and technology is also contributing significantly to increasing volume and toxicity of waste generated [20].

Improper management of solid waste has serious environmental and health consequences. Such practices contribute to widespread environmental pollution as well as to the spread of diseases [8]. Health deterioration, accidents, flood occurrences and environmental pressures are just a few of negative effects. Other environmental effects also include pollution of surface and underground waters, unpleasant odour, pest infestation and gas explosions. Therefore, the hazards associated with inappropriate solid waste disposal and associated environmental health impacts should be of utmost concern to waste management experts. If waste pollution persists uncontrollingly to the future, it may lead to unprecedented health casualties [25], [3].

In vast majority of developing countries such as Turkey, municipal authorities lack resources and trained staff to provide necessary facilities and services for solid waste management in order to support an adequate quality of life for their rapidly growing populations [4].

In the 1960s, 3-4 million tons of municipal solid wastes were generated in Turkey. However, approximately 28 million tons of municipal solid waste was generated annually. These values indicate that solid waste generation increases year by year in Turkey [27]. The quantities of solid wastes quoted from various population groups in Turkey are given as kg/capita.day in Table I.

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TABLE I
THE QUANTITIES OF SOLID WASTES ACCORDING TO POPULATION GROUPS IN TURKEY [27]

Population Groups	Waste Quantities (kg/capita.day)
-2000	1.65
2001-5000	1.10
5001-10000	1.11
10001-25000	1.10
25001-50000	1.03
50001-100000	1.15
100001-500000	1.29
500001-1000000	1.46

There are substantial differences in the composition of solid wastes among the cities of Turkey. The type and quantity of solid wastes generated by a community depends on its culture, climate, difference in traditional fuel, variations in food, etc. [24]. Table II shows waste composition for some low, middle and high income cities of Turkey.

TABLE II
SOLID WASTE COMPOSITION FOR LOW, MIDDLE AND HIGH INCOME CITIES OF TURKEY [27]

Waste Components	High-Income Cities	Middle-Income Cities	Low-Income Cities
Organics (%)	50-60	50-55	70-75
Recyclable (%)	30-40	20-30	10-20
Other	10-20	20-25	15-20

As seen in Table II, in low-income cities, organic waste generation is higher than high-income cities. However, recyclable waste generation is higher in high-income cities.

In cities of Turkey, community initiatives in solid waste management are currently being supported by the municipal authorities. In many cities of Turkey, deficiencies in the provision of waste services are results of inadequate financial resources, lacking management and technical skills of municipalities and inadequacy of government authorities in dealing with the rapid growth in demand for services. Although budgets are limited, the willingness to pay for well rendered services is high. Main solid waste indicators in municipalities of Turkey are presented in Table III.

TABLE III
MAIN SOLID WASTE INDICATORS OF MUNICIPALITIES [27]

Total number of municipalities	1396
Number of municipalities receiving solid waste services	1391
Rate of population receiving solid waste services in total population (%)	91
Amount of solid waste collected (1000 tonnes/year)	28 011
Solid waste disposal methods	
Open dumping (%)	35.50
Open incineration (%)	0.01
Discharge to surface water (%)	0.06
Burial (%)	0.02
Composting (%)	0.40
Sanitary landfilling (%)	63.60
Others (%)	0.41

Poorly managed hazardous wastes present another growing threat to cities, particularly when industrial discharges are poorly regulated and when municipal solid waste management is inadequate. Human exposure to these wastes- whether inhaled, ingested or absorbed through the skin- may result in short-term acute effects, long-term irreversible chronic diseases or genetic mutations affecting future generations [4].

III. AIR POLLUTION

Air pollution is a major cause of morbidity and mortality in the developing world, and its effects are mainly observed in cities where air pollution is worst [14]. Exposure to air pollution can result in breathing difficulties, hypertension, respiratory disease, impaired urological development, heart attracts, strokes and death [4]. Air pollutants of greatest concern are carbon monoxide, hydrocarbons, sulphur oxides, nitrogen oxides, suspended particulate matter, lead and secondary pollutants such as ozone [28].

Air pollution may have both indoor and outdoor sources. Outdoor air pollution is a growing problem in many cities that have poor natural ventilation and high rates of motorization, industrialization or coal use. In large cities of Turkey, a significant proportion of the air pollution is caused by motor vehicular exhaust. Lead poisoning from air contaminated with lead is a serious problem in countries where gasoline still contains lead, or where small local refineries are in close proximity to housing [26]. Indoor air pollution is most often associated with the use of biomass fuels, particularly for heating and cooking, which results in daily exposure to high levels of toxic compounds. Indoor air pollution affects both rural and urban populations [6].

Sulphur dioxide (SO_2) and particulate matter (PM) are monitored systematically in Turkey since 1980. SO_2 is usually emitted during the combustion of fossil fuels and is among the most prevalent air pollutants in cities, and contributes to the formation of sulphuric acid, the formation of sulphate aerosols and the deposition of sulphate and sulphur dioxide at the ground surface [5], [11]. PM has wide range of sizes and originates from many different stationary and mobile sources. They may be emitted directly by a source or formed in the atmosphere by the transformation of gaseous precursor. Particulates cause adverse impacts on the environment via reduced visibility and changes in the nutrient balance through deposition processes and on health [2].

European Union air quality standards for 24-hour-mean are 350 $\mu g/m^3$ for SO_2 and 50 $\mu g/m^3$ for PM_{10}. In Turkey, the provincial centers having annual maximum, minimum and average PM and SO_2 concentrations are given in Figs. 1 and 2, respectively.

As seen in Figs. 1 and 2, although maximum values of PM and SO_2 concentrations in some cities of Turkey exceed EU standards in all years between 2007 and 2014, the average values of them are below the standards. The most important reason for urban air quality is the low quality coal and high sulphur content petroleum consumption in households and transportation. However, SO_2 and PM concentrations have declined rapidly in recent years because government has banned import of low quality local coal in the cities.

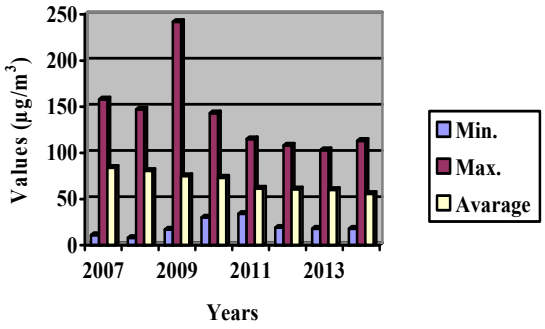

Fig. 1 The annual values for particulate matter concentrations [27]

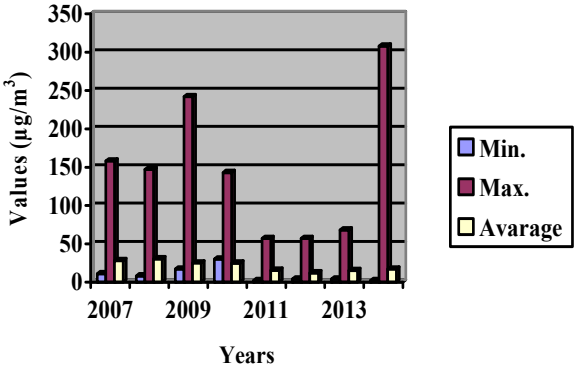

Fig. 2 The annual values for SO_2 concentrations [27]

IV. Noise Pollution

Since 1970 s, "noise" has been generally considered as a major problem of annoyance in cities and is being taken into consideration by urban planners [19]. The frequency of complaints from noise increases with the size of cities and that exposure to noise is inversely related to family income, with those on lower levels of income being the most exposed to ambient noise. Noise in large cities is considered by the World Health Organization to be the third most hazardous type of pollution, right after air and water pollution [30]. There are different sources of noise, but they generally depend on vehicle moving along roads, industrial plants and human activity. Transportation noise represents a large majority of external noise affecting people in large cities and their surroundings [10].

The effects of noise can be evaluated physiologically but also psychologically [16]. Sleep disturbances are among non-auditory deleterious effects of noise [17], [23]. Moreover, direct effects of noise on various cognitive abilities of humans such as long-term memory, mental arithmetic activity, visual tasks etc. have been demonstrated [18].

The rapid growth of Turkey's cities has generated a correspondingly rapid growth in travel demand, overwhelming the limited transport infrastructure. The sharply increasing levels of motor vehicle ownership and usage, in particular, have resulted in alarming levels of congestion, noise, and traffic danger. Total number of vehicles by years is shown in Fig. 3.

Automobiles are being used more than 90% of public transport in Turkish cities. Indeed, many Turkish cities have no rail transport at all. Busses and minibuses carry less than a third of public transport passengers. Number of vehicles by type is illustrated in Fig. 4.

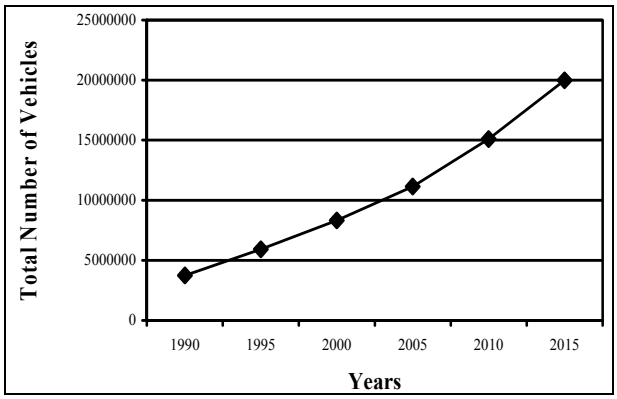

Fig. 3 Total Number of vehicles by years [27]

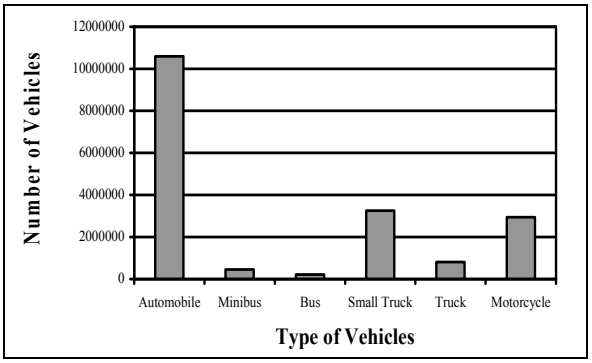

Fig. 4 Number of vehicles by type, 2015 [27]

Industrial plants can also be a source of excessive noise for the surroundings in Turkey. This type of noise can be complex in nature, owing to the wide variety of sources. It can be spontaneous or more or less continuous, with large variations in intensity. Low-frequency noises are not so well attenuated by surrounding structures and they can be transmitted across large distances. Building construction and ground work (e.g. hammering, crane or heavy trucks) may generate high noise emissions [16].

Many field studies have been conducted to measure the outdoor noise environment in several countries however they are mainly concerned with physical measurements of urban noise. Urban planners make a concerted effort to include human evaluations of environmental quality but subjective evaluations remain sporadic and urban noise is still considered as unwanted sounds [15], [12], [20]. Recent studies have pointed out the limits of such approaches [22], [21], [19] and made attempts to find new methods to investigate the effects of urban noises on people.

The Noise Control Regulation of Turkish Republic that aims at "Reducing Noise Pollution" to acceptable levels

considers noise as part of a global problem faced by cities in Turkey. Along with the evolution of urban environment policy in 1980s, the aim is not just to preserve specific area but also to improve conditions of places with local access in terms of noise pollution.

V. Water Pollution

During the last two decades, water demand has increased rapidly in developing countries as a result of high population growth, improvement of living standards, rapid urbanisation, industrialisation and improvement of economic conditions while accessibility to sources of water is decreasing [1]. Water treatment plants for municipal water supplies are sometimes inadequate to meet the demand [14].

TABLE IV
Main Drinking Water Indicators of Municipalities [27]

Total number of municipalities	1396
Number of municipalities receiving drinking water network services	1394
Rate of population served by drinking water network in total population (%)	91
Water distribution by municipal water supply network (million m^3/year)	3394
Number of drinking water treatment plants	
Physical	69
Conventional	165
Advanced	147
Number of municipalities served by drinking water treatment plants	436
Rate of population served by drinking water treatment plants in total population (%)	54

The wastewater management situation in cities of Turkey leads to acute water pollution problems. There is also a problem of uncontrolled industrial discharges into municipal sewers, increasing organic loads and introduction of a range of chemical contaminants that can damage sewers, interrupt treatment processes and create toxic and other hazards. Not only do these degrade the aesthetic life of the city, but they also constitute a reservoir for cholera and other water-related diseases. In recent years, there has been remarkable consensus about market- and environment-friendly policies for managing water resources and for delivering water and sanitation services efficiently. Main drinking water indicators in municipalities of Turkey are presented in Table IV.

The costs of urban water pollution also fall back in the cities in the form of higher water supply costs. Lack of financial resources impedes investment in sanitation, drainage, and other essential urban environmental services, especially in small cities and towns in Turkey. This problem has been overcome in some cases with the creation of special municipal development funds or rotating funds to finance environmental investments.

VI. Conclusion

Nearly half the world's population now lives in urban settlement. Urban offers the lure of better employment, education, health care, and culture; and they contribute disproportionately to national economies. However, current worldwide urbanization presents important challenges of urban poverty, megacities, social deterioration, and environmental degradation. The main contributors to environmental degradation are the absence of full participation, inadequate governance, inadequate regulatory and economic policies and insufficient knowledge and information. To reverse urban environmental degradation in most developing countries such as Turkey, it is essential to understand and specify the factors that perpetuate the lack of appropriate preventive and curative environmental actions.

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