

**YANGON UNIVERSITY OF ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME**

**PUBLIC PERCEPTION ON THE EFFECTS OF
ENVIRONMENTAL NOISE POLLUTION ON
PEOPLE'S HEALTH
(A CASE STUDY IN KAMAYUT TOWNSHIP, YANGON)**

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ABSTRACT

Though environmental noise pollution is an increasing problem, especially in urban area, people tend to forget about it because it cannot be seen or smell like other pollutions such as air, water, soil and light. The aim of this study is to evaluate the perception of public on environmental noise pollution and its effect on health and to investigate the major source of noise in Kamayut Township. Descriptive method with quantitative approach was used for this study. The structured questionnaire was used to collect information from respondents. This study found that the major source of noise in Kamayut Township is noises from car with 48% of respondents, because it is one of the downtown urban areas with crowded transport network in Yangon. It also found that the psychological health of the respondents due to noise pollution is more affected than the physical health effect. In term of awareness, the results showed less awareness since 63% of the respondents think noise pollution cannot have a serious effect on health, 75% of the respondents have never discussed about noise pollution and 63% of the respondents do not know there are rules and regulations to control noise pollution. Respondents in this study know that the noise pollution can have effects on human health but do not think it will affect seriously.

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LIST OF ABBREVIATIONS

CBA	Cost-benefit analysis
CHD	Coronary heart disease
CVDs	Cardiovascular diseases
dB	Decibel
dBA	A-weighted decibel
EEA	European Economic Area
END	Environmental Noise Directive
ENIA	Environmental noise impact analysis
EU	European Union
Hz	Hertz
ICAO	The International Civil Aviation Organization
NGOs	Non-governmental Organizations
RANCH	Road traffic noise and Aircraft Noise exposure and Children's cognition and Health
UNCED	The United Nations Conference on Environment and Development
WHO	World Health Organization
YCDC	Yangon City Development Committee
YGTP	Yangon Region Traffic Police Department

CHAPTER I

INTRODUCTION

1.1 Rationale of the Study

Any unwanted sound from various sources is considered to be noise pollution. In urban area, noise pollution is a consequence of industrial, transportation, commercial, and recreational activities. In developing countries, population growth, urbanization and technological development are the main driving forces responsible for the continuous growth of noise pollution. Noise pollution is an underrated environmental problem because of the fact that it can't be seen, smelt, or tasted. World Health Organization (Report 2001) stated that "Noise must be recognized as a major threat to human wellbeing."

Environmental noise is the summary of noise pollution from transportation, construction sites, industrial and recreational activities, except noise at the industrial workplace. Main sources of environmental noise include road traffic, train, aircraft, loudspeaker, industries, construction, and the neighborhood. Typical neighborhood noise comes from religious ceremonies; from restaurants; from commercials; from live or recorded music; from sporting events including motor sports; from playgrounds and car parks; from people quarrelling; and from domestic animals such as barking dogs. Environmental noise in and around buildings and communities in which people live and work has gradually and steadily increased and is currently a major public health problem in many cities worldwide.

The normal human ear can detect sounds that range between 0 dBA (hearing threshold) and about 140 dBA, with sounds between 120dBA and 140 dBA causing pain (pain threshold) (Journey Into The World Of Hearing, 2018).Kiernan (1997) finds that even relatively low level of noise affects human health adversely. It may cause hypertension, disrupt sleep and/or hinder cognitive development in children. There are many negative effects of excessive noise or sudden exposure to noise, such as widespread use of loudspeakers in ceremonies and indiscriminate use of horn by the vehicles. The excessive noise may cause physiological and psychological health problems such as, irritation, human performance and actions, hypertension, heart

problems, tiredness, headache, deafness, nervous breakdown, high blood pressure, and dizziness and causing stress. Moreover it might cause permanent loss of memory or a psychiatric disorder (Bond, 1996). Thus, it can be said that the noise is a silent killer growing day-by-day.

The World Health Organization (WHO) estimates that 10% of the world population is exposed to sound pressure levels that could potentially cause noise induced hearing loss. Motor vehicles are the main sources of urban noise emission contributing about 55% to the total noise. The growing vehicular population gives rise to noise pollution and associated health effects and can cause both short-term and long-term psychological and physiological disorders (Banerjee, Chakraborty, Bhattacharyya, & Gangopadhyay, 2008). Some studies show that people who are exposed to high road traffic noise levels have significantly higher prevalence of hypertension and children living in areas with high level of noise pollution have delayed reading ages, poor attention levels, and high stress levels.

Noise pollution is also a problem in many developed countries but the concerns for this source of pollution are very limited for most countries in the developing regions. Nowadays, noise pollution is rapidly increasing in many developing countries with improvement in technology and growth of urban centers but no standard measures have been taken to effectively control noise and its effect. In the developed nations, most states have adopted legislation or recommendation setting emission limits for noise exposure. In many developing countries, including Myanmar, noise pollution is a typical attribute, probably because of poor awareness and poor public education. In Myanmar, little or no concern has been raised for noise pollution, and only very few studies are also available in this regard.

Although there are some laws to control noise pollution in Myanmar, they are not regulated effectively. Some Myanmar citizens don't even know these laws exist. There are laws regarding the use of loudspeakers at public places in Myanmar, but they are not effective and are rarely followed. Moreover, there are also laws to reduce traffic noise pollution. One is a ban on using car horns and the other is a ban on motor cars and motor cycles with noisy power exhausts. These are also cannot be regulated effectively, probably due to the inadequate traffic regulating and civic consciousness among drivers.

Noise is an invisible and often disregarded form of pollution, yet its effects on urban health are quite alarming. However, Myanmar has not yet fully recognized

noise pollution as human health risk factor. This could be due to the lack of baseline information on the level of noise in industrial, commercial, and residential areas of the urban setting as well as its effect on human health. Since noise pollution is a slow and subtle killer, some people seem to care less about it. This thesis studied the people living in Kamayut Township since it is the downtown urban area with pretty high population and a natural hub for public transport, the environmental noise in this township is considered to be high.

1.2 Objectives of the Study

The objectives of this study are

1. To investigate the sources of noise pollution in Kamayut Township.
2. To evaluate the public perception on the environmental noise pollution and its effects on people's health.

1.3 Method of Study

The research methodology used in this paper is mainly a descriptive method. Both primary and secondary sources of data are used for this study. For the primary data, three wards are selected by using the simple random sampling method and total of 150 random samples are chosen proportionately among three wards. Sample population which are randomly selected the people who are 10 years old and above because they are considered to be conscious of noise effect. The structured questionnaire is adopted to conduct the public perception on the effect of environmental noise pollution on people's health, and the effect of noise in their daily life in Kamayut Township.

1.4 Scope and Limitations of the Study

This research study focuses on people living in Kamayut Township. There are ten urban wards in the Kamayut Township and the three sampling locations of Kamayut Township are selected with simple random sampling for noise pollution study. Therefore, this paper is conducted in ward (5), ward (6), and ward (7) among the total wards of Kamayut Township. The present investigation and analysis of environmental noise pollution in these three wards was conducted from March to April, 2019.

Some environmental noise such as aircraft noises and noise from industries are not consider as the major noise source because Kamayut Township is far from airport and industrial zone.

1.5 Organization of the Study

There are totally five chapters in this thesis. In detail, Chapter one is the introduction chapter that includes rationales, objectives, scope and method of the study, and organization itself. Chapter two is literature review for environmental noise pollution and its effects on human health. Chapter three focuses on the environmental noise policy and regulation in selected countries. Chapter four presents information on the assessment survey, the respondents, and findings of the survey. Chapter five is conclusion with findings and the recommendation.

CHAPTER II

LITERATURE REVIEW

2.1 Environmental Noise Pollution

Sound is a medium of communication and without it would be impossible to lead human daily life. However, it becomes noise when its level increases beyond certain limits. Difference between sound and noise also depends upon the habit and interest of the person or species receiving it, the surrounding conditions and impact of the sound generated during that particular duration of time. There are two kind of noise pollution, environmental noise/community noise (non-industrial noise pollution) and occupational noise (industrial noise pollution). This study is only focuses on environmental noise pollution and not on occupational noise pollution.

Environmental noise, sometimes called as community noise is one of the most common pollutant. It is defines as an unwanted or harmful outdoor sound created by human activities, such as noise emitted by means of transport, road traffic, rail traffic, air traffic, and industrial activity, educational, recreational, construction, public works and the neighborhood, expect noise at the industrial workplace. The term to which noise can act as a stimulant and stressor is related to the noise source, onset of the noise, duration and characteristics of the sound and whether noise exposure is voluntary or involuntary. For example, music festival is likely to bring out a different physical and emotional reaction than a car horn, a fire truck or ambulance, the neighbor's quarreling and barking dog.

The Environmental Conservation Law by Ministry of Environmental Conservation and Forestry defines noise pollution as the occurrence of sound unit which causes annoyance, fatigue, loss of hearing or interference with the perception of other sounds. The Environmental Noise Directive (END) defines environmental noise as “unwanted or harmful outdoor sound created by human activities, including noise from road, rail, airport and industrial sites”. END is the main European Union (EU) instrument to identify noise pollution levels and to trigger the necessary action both at Member State and at EU level. Hence it is defines as unwanted or harmful

sound, noise is no less a pollutant than the toxic chemicals in the environment. Although the environment does not become unclean, it has adverse effects on human health.

Environmental noise pollution differs from other types of pollution categories, such as occupational noise exposure, because it has a large number of sources inside each community. It has often been referred to as the 'forgotten pollutant' but is now recognized as an environmental and public health issue which needs to be addressed in modern society. In recent times, the environmental noise pollution has been recognized as one of the major environmental factors that adversely affects the quality-of-life in all countries of the world, particularly the urban areas. Levels of environmental noise pollution increase rapidly and becoming a serious source of discomfort and danger with the progress of rapid increase in human activities such as transportation, industrialization, and urbanization.

2.2 Measurement of Intensity of Sound

Sound travels in the form of waves through compression and refraction exerting pressure on the atmosphere. As noise is emitted from a source it spreads in the air and its level decreases as the distance from the source increases. This attenuation is due to several factors:

- i. The distribution of acoustic energy over a geometrically expanding area within increasing distance.
- ii. Noise screening by barriers between noise sources and receivers.
- iii. Sound absorption by the air.
- iv. Sound absorption by the ground.

Other factors influencing noise propagation include wind, temperature gradients and humidity (WHO, 1990). These are important factors to consider when determining noise impacts on the community.

Sound intensity is measured by the sound pressure on a scale called decibel (dB) scale. The instrument used for this measurement is called a decibel meter. Sound has pitch in addition to pressure. A high-pitch sound seems louder than a low-pitch sound of the same pressure. It is also more annoying than a low-pitch sound of the same intensity. Thus, the sound pressure is weighted for high-pitch sounds to which humans are more sensitive. The unit of measuring sound is dBA. It is an expression of the relative loudness of sounds in air as perceived by the human ear. In the A-

weighted system, the decibel values of sounds at low frequencies are reduced compared with unweighted decibels. It is because the human ear is less sensitive at low audio frequencies, especially below 1000 Hz, than at high audio frequencies. A sound becomes annoying when it reaches a pressure level of 75 dBA and becomes painful when it goes above 120 dBA. Even a low level noise may be damaging if encountered for longer durations. The noise levels of common sounds in dBA are given in Table (2.1).

Table (2.1) Sound Levels and Their Effects on Humans

Activity	Sound Pressure (dBA)	Perceived Loudness	Effect
Rocket engine	180	Painful	Eardrum rupture
Jet take-off (25 m away)	150	Painful	Eardrum rupture
Aircraft carrier deck	140	Painful	
Jet take-off (100 m away)	120	Uncomfortably loud	
Thunderclap, textile loom, live rock music, jet take-off (161 m away), siren (in close range), chainsaw	120	Uncomfortably loud	Human pain threshold
Steel mill, riveting, automobile horn (1 m away), stereo held close to ear	110	Uncomfortably loud	
Jet take-off (305 m away), subway, outboard motor, power lawnmower, motorcycle (8 m away), farm tractor, printing plant, jackhammer, garbage truck	100	Uncomfortably loud	Serious hearing damage (8 h)
Busy urban street, diesel truck, food blender, cotton-spinning machine	90	Very loud	Hearing damage (8 h), speech interference

Table (2.1) Sound Levels and Their Effects on Humans (cont'd)

Garbage disposal, washing cloth, average factory noise, freight train (15 m away), dish washer	80	Very loud	Positive hearing damage
Freeway traffic (15 m away), vacuum cleaner, noisy office or party	70	Moderately loud	Annoying
Conversation in restaurant or office, background music	60	Moderately loud	Intrusive
Quiet subway (day time), conversation in living room	50	Moderately loud	Quiet
Library, soft background music	40	Quiet	Quiet
Quiet area (night time)	30	Quiet	Quiet
Whisper, rustling leaves	20	Quiet	Quiet
Breathing	10	Quiet	Quiet

Source: Environmental Pollution and Health by Ahluwalia, V. K, Energy and Resources Institute

Apart from hearing loss, such an environmental stressor as noise may have dangerous effects on other aspects of health, such as cardiovascular diseases, hypertension, stress, cognitive impairment in children, lack of concentration and memory loss.

2.3 Causes of Environmental Noise Pollution

Noise Pollution has become a major problem of modern times. Due to increasing in technology, population, urbanization and transportation (rail, air, and road), the problem of noise pollution is assuming serious dimensions. Basically, noise has become an inevitable evil of growth and development. Urban area has more environmental noise pollution compare to rural area, since it has many sources that can cause noise pollution than rural area. Moreover, homes are very close to one another in urban area, increasing the amount of domestic noise. There are many

causes of environmental noise pollution in urban area but the following are some main causes of them.

i. **Transportation**

Transportation causes of noise pollution predominantly encompass noise from traffic, rails, and aircraft. Traffic is the biggest source of noise pollution in today's times, especially in urban areas. The numbers of automobiles on the roads are increasingly becoming overwhelming owing to automobile revolution in urban settings. As the number of usage of automobile increase, it further exacerbates the problem of transport noise. Increased traffic has brought about automobile congestion that produces noise through repeated hooting. Sound produced by the exhaust systems of trucks, automobiles, buses and motorcycles can cause a lot of noise. The noise created by a bus or truck is 10-15 times that of an automobile. Airplanes and jets also constantly make big sounds over the houses near airports. Locomotive engines and siren of trains also increase the environmental noise pollution.

ii. **Events**

Noise is at its peak in most of events. Whether it is religious festival, marriage, recreational activity or place of worship, people normally flout rules set by the local administration and create nuisance in the area. In some events, people play songs on full volume from early morning to midnight and make the condition of people living nearby pretty worse. Sometimes people attract the attention by selling things through making loud noise. This noise, in the long run, can have negative effects on the people nearby.

iii. **Poor Urban Planning**

Poor urban planning also plays an important role in most developing countries. Congested houses, large families sharing small space, fight over parking, quarreling noise from neighborhoods leads to noise pollution which may disrupt the environment of society.

iv. **Household**

Household utilities are sources of noises and can cause disturbance to the peace of the mind. Common sources household noise pollutants include domestic gadgets such as pressure cookers, washing machines, mixer-grinders, hair dryer, air conditioners, sewing machines and vacuum cleaners. Moreover, many indoor noises such as the banging of doors, noise of playing children, crying of infants, moving of furniture, loud quarrels, house renovations and loud conversation of the inhabitants

can also cause noise pollution. Besides these are the entertainment equipment in the house, such as television, radio, record player, musical instrument and music system are also sources of noise pollution. These gadgets, household behaviors and entertainment equipment can cause a disturbance to everyone in the neighborhood.

v. **Animal**

Noise pollution can cause by animals especially from the increasing number of stray dog. In many developing countries, there is no specific control for increasing stray dog population. As the number of stray dog increase, the noise of dog barking and bickering annoy the environment.

vi. **Construction Activities**

Due to the increasing in population growth and urbanization, construction of bridges, buildings, roads and overpasses take place in many parts of the urban area. Use of different machines and tools in various constructions works leads to increased noise pollution.

vii. **Industrialization**

Most of the industries use big machines which are capable of producing large amount of noise. Apart from that, various equipment like boilers, compressors, generators, exhaust fans, grinding mills are also generate considerable noise to the environment. It is therefore some countries recommended to grow trees in the premises of industries, which act as absorbents of noise.

viii. **Other Sources**

There are also many other sources that cause noise pollution in urban area, such as, push cart seller, water pump motor, car wash shop, car work shop, welding shop, noise from warehouse; and market places, restaurants, tea shops, schools, colleges, bus stands, and railway stations, due to the huge population present there.

2.4 Effects of Environmental Noise Pollution on People's Health

The effect of noise on human health depends on the quality and duration of the noise, and the sensitivity of the individual. According to the World Health Organization (WHO), noise can affect human physically and psychologically. Physical effects include sleepless, high blood pressure, cardiovascular disease, hearing impairment, headache, problems associated with digestive systems and general fatigue. Psychological effects include reduced efficiency, lack of

concentration, absenteeism, stressed and higher rates of accidents and injuries. It can also lead to ill temper, quarrels, or enmity.

The World Health Organization, European Community members and numerous other countries have determined there is ‘sufficient evidence’ linking noise with annoyance, school children’s performance, sleep disturbance, heart disease and hypertension. Absence of quiet and restorative areas in the society affects human health and well-being. Although there is no strong evidence that noise causes mental ill-health, it is possible that some vulnerable groups, who are exposed to noise over which they have no control, may be vulnerable to mental health problems. What is more certain is that those with existing mental health problems, usually either depression or anxiety, are more prone to be annoyed and disturbed by environmental noise exposure than the general population. There is growing evidence that long term exposure to environmental noise leads to both impaired cognitive function (reading, motivation) and health (annoyance, blood pressure) in children. Impairment of early childhood development and education by environmental pollutants such as noise may have life-long effects on achieving academic potential and good health.

High level of noise may rupture the eardrum cause hearing impairment. While the direct physical consequence of loud noise, especially over a period of time, can cause hearing loss and tinnitus (auditory effect), noise at lower levels can have an indirect impact on human psychological systems (non-auditory effects). The non-auditory health effects of noise are defined as ‘all effects on health and wellbeing that are caused by exposure to noise, with the exclusion of effects on the hearing organ and the effects that are due to masking of auditory information (namely communication problems)’ (IEH–MRC Institute for Environment and Health, 1997).

2.4.1 Auditory Effect

Hearing loss: Hearing loss is a partial or total inability to hear. It is a reduced inability to hear sound in the same way as other people. The causes of hearing loss and deafness can be congenital or acquired. It may be mild, moderate, severe, or profound and may occur in one or both ears. The damage to the ear can be temporary or permanent depending on the intensity and duration of sound. Maximum damage is caused by continuous exposure to high intensity noise. It has been found that noise of high intensity impulse, which can result from an explosion, or a sudden excessive noise of more than 100 dB causes instantaneous damage or acoustic trauma. Hearing

loss due to excessive noise exposure is acquired.

Table (2.2) Permissible Noise Exposure

Sound Level dBA	Duration per day (hours)
90	8
95	6
96	4
97	3
100	2
102	1
110	1/2
115	1/4 or less

Source: Environmental Pollution and Health by Ahluwalia, V. K, Energy and Resources Institute.

Hearing is affected if the path of motion is interrupted. The overall permissible levels of noise exposure are given in Table (2.2). The hearing damage is a cumulative process. Low-frequency noise is less damaging than noise in the mid-frequency noise. All individual are not equally susceptible to hearing loss by noise of the same intensity. The hearing loss resulting from noise is most pronounced near 4000 Hz. However, it spreads over the frequency range with increased exposure time. On being exposed to noise, the sound waves create mechanical motion in the middle ear. This is followed by translation of mechanical motion into nerve impulses.

It has been found that noise level less than 25 dB does not pose any problem in hearing, but noise level greater than 25 dB causes hearing difficulty. In the case of difficulty in hearing sound greater than 50 dB, hearing aid is required. According to WHO, over 5% of the world's population or 466 million people has being disabling hearing loss with 432 million adults and 34 million children. In children, hearing problems can affect the ability to learn spoken language and in adults it can create difficulties with social interaction and at work. In some people, particularly older people, hearing loss can result in loneliness. The majority of people with disabling hearing loss live in low and middle-income countries. Approximately one third of people over 65 years of age are affected by disabling hearing loss. The prevalence in this age group is greatest in South Asia, Asia Pacific and sub-Saharan Africa. It is estimated that by 2050 over 900 million people or one in every ten people will

havedisabling hearing loss.

Tinnitus: Tinnitus is the general term for sound perception (for instance, roaring, hissing or ringing) that cannot be attributed to an external sound source. To put it in terms of auditory abilities, tinnitus is the inability to perceive silence. Tinnitus is very often found to be present concomitantly with hearing loss. Tinnitus can be a transient sensation in which case it ceases spontaneously lasting just few seconds. It can also be permanent as such affecting the quality of life and interfering with daily life activities. Noise exposure is the commonest cause of tinnitus. According to WHO, noise ranks second in disease causing because of pollution in the world and tinnitus is the third worst symptom affecting human. About 15-20% of world population suffers from tinnitus and in about 25% of this affected population, it interferes with daily activity. It is also note that young adults expose themselves to high levels of noise from personal listening devices, attending night clubs and other loud leisure noise because they are not aware of the import of such exposures and the resulting tinnitus. About 89.5% of young adults had transient tinnitus after exposure to excessive noise. Tinnitus may be classified according to its different attributes: duration of a single episode (seconds, minutes; intermittent, continuous), temporal duration (days, months, years) or severity (degree of annoyance, interference with daily living). Tinnitus can cause in some patients one or several of the consequences, such as sleep disturbance, cognitive effects, anxiety, psychological distress, depression, communication and listening problems, frustration, irritability, tension, inability to work, reduced efficiency and restricted participation in social life.

2.4.2 Non-Auditory Effects

Cardiovascular Disease: Acute exposure to noise activates nervous and hormonal responses, leading to temporary increases in blood pressure, heart rate, and vasoconstriction. Studies of individuals exposed to occupational or environmental noise show that exposure of sufficient intensity and duration increases heart rate and peripheral resistance, increases blood pressure, increases blood viscosity and levels of blood lipids, causes shifts in electrolytes, and increases levels of epinephrine, norepinephrine, and cortisol. After prolonged exposure, susceptible individuals in the general population may develop permanent effects, such as hypertension and ischemic heart disease associated with exposures to high sound pressure levels (Passchier-Vermeer 1993; Berglund & Lindvall 1995). The magnitude and duration of the effects

are determined in part by individual characteristics, lifestyle behaviors and environmental conditions. Sounds also evoke reflex responses, particularly when they are unfamiliar and have a sudden onset. The body's fight or flight response leading to autonomic nervous and endocrine effects seen with chronic daily level of noise can lead to elevated blood pressure and heart rate (Goines &Hagler, 2007).

Studies have revealed a significant relationship between daily traffic noise and night time aircraft noise and an increase in blood pressure (Jarup et al., 2008) and association between road traffic noise and self-reported doctor diagnosed hypertension (Bluhm, Berglind, Nordling&Rosenlund, 2007). Three studies conducted in Amsterdam, Bonn and Erfurt (Germany) found statistically significant relative risks of hypertension for those living in areas exposed to 65–70 dBA. Babisch(2000) also concludes that there seems to be greater evidence of ischemic heart disease risk among those exposed to noise levels above 65–70 dBA. Increased risks of ischemic heart disease with relative risks of 1.1 to 1.5 (not statistically significant) were found in those most highly annoyed by or disturbed by traffic noises (65–70 dBA) compared to noise levels of 51–55 dBA (6–22h).

Children are at risk as well. There has also been an increase in research on the impact of noise and childhood hypertension. Seven out of nine studies (1968–90) reviewed by Evans and Lepore (1993) report elevations of resting blood pressure among children who are chronically exposed to aircraft and road traffic noise. Babisch (2000) also concludes that consistent blood pressure increases were found in children. A cross-sectional study in Los Angeles found significant increases in mean diastolic and systolic blood pressures in children attending schools near the airport (Cohen et al., 1980).

Even though the increased risk for noise-induced cardiovascular disease may be small, it assumes public health importance because both the number of people at risk and the noise to which they are exposed continue to increase.

Cognitive Impairment in Children: The most consistent effects of noise found in children are cognitive impairments, although such effects are not uniform across all cognitive tasks. Tasks involving central processing and language comprehension, such as reading, attention, problem solving, and memory appear to be the most affected by exposure to noise. Exposure during critical periods of learning at school could potentially impair development and have a lifelong effect on educational attainment.

For cognitive effects of noise, it is important to separate the effect of day and night-time exposure. Night-time exposure is more likely to interfere with storing of the material to be remembered or learnt while day-time exposure may affect encoding and acquisition of information. However, noise-induced chronic insomnia may lead to day-time effects in terms of fatigue, memory difficulties, concentration problems and slow reaction time, thus resulting in poor work performance and difficulties in learning new things. Most studies on day-time noise at schools and cognitive impairment among children show that traffic noise may affect children in many ways, but that it primarily impairs reading comprehension, memory and motivation.

“Road traffic noise and Aircraft Noise exposure and Children’s cognition and Health” (RANCH), the largest study on noise and cognitive functioning among children, assessed the effects of exposure to aircraft and road traffic noise on cognitive performance amongst almost 3,000 children in the ages 9–10 years, attending 89 schools near three major European airports. It was found that chronic aircraft noise at school was associated with a significant impairment in reading comprehension. Road traffic noise was not associated with reading comprehension or any of the other outcomes.

The effects of aircraft noise might be greater than road traffic because of its intensity, variability and unpredictability, which disrupt the children’s concentration and distract them from learning tasks, and that road traffic noise, which has a more constant nature, may allow children to habituate and therefore would be less distracting. Cognitive effects of traffic noise exposure at home could be mediated through sleep disturbances since lack of restorative sleep is harmful both to the physical and mental health. So far, no studies are available to quantify to what degree exposure to traffic noise at home impairs day-time performance and learning.

Sleep Disturbances: Sleep disturbance is one of the most common complaints raised by noise-exposed populations and it can have a major impact on health and quality of life. Sleep is a biological necessity for mental and physical health and loss of sleep may have several detrimental health effects. Studies have shown that noise affects sleep in terms of immediate effects (e.g. arousal responses, sleep stage changes, awakenings, body movements, total wake time, autonomic responses), after-effects (e.g. sleepiness, daytime performance, cognitive function deterioration) and long-term effects (e.g. self-reported chronic sleep disturbance). Some studies have

found that coronary heart disease (CHD) can be the long-term health effects resulting from sleep disturbance.

Continuous noise in excess of 30 dBA disturbs sleep. For intermittent noise, the probability of being awakened increases with the number of noise events per night. Road-traffic noise at 50 to 60 dBA maximum increases the time taken to fall asleep. Older people are more affected by noise during sleep and children seem less affected to noise disturbance during sleep, although they show a larger amplitude heart-rate response to noise during sleep.

Annoyance: According to the WHO definition of health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”, a high level of annoyance caused by environmental noise should be considered as one of the environmental health burdens. Noise annoyance is caused by noise related disturbances of the individual’s speech communication, concentration and performance of tasks and it is commonly associated with a variety of negative responses, such as anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion. Furthermore, stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress have been found to be associated with noise exposure as well as noise annoyance. Some public health experts feel that severe forms of noise-related annoyance should be considered a legitimate environmental issue affecting the well-being and quality of life of the population exposed to environmental noise.

2.5 Noise Management

The goal of noise management is to maintain low noise exposures, such that human health and well-being are protected. The specific objectives of noise management are to develop criteria for the maximum safe noise exposure levels, and to promote noise assessment and control as part of environmental health programs. This is not always achieved (Jansen 1998). The United Nations’ Agenda 21 (UNCED 1992), as well as the European Charter on Transport, Environment and Health (London Charter 1999), both support a number of environmental management principles on which government policies, including noise management policies, can be based. These include:

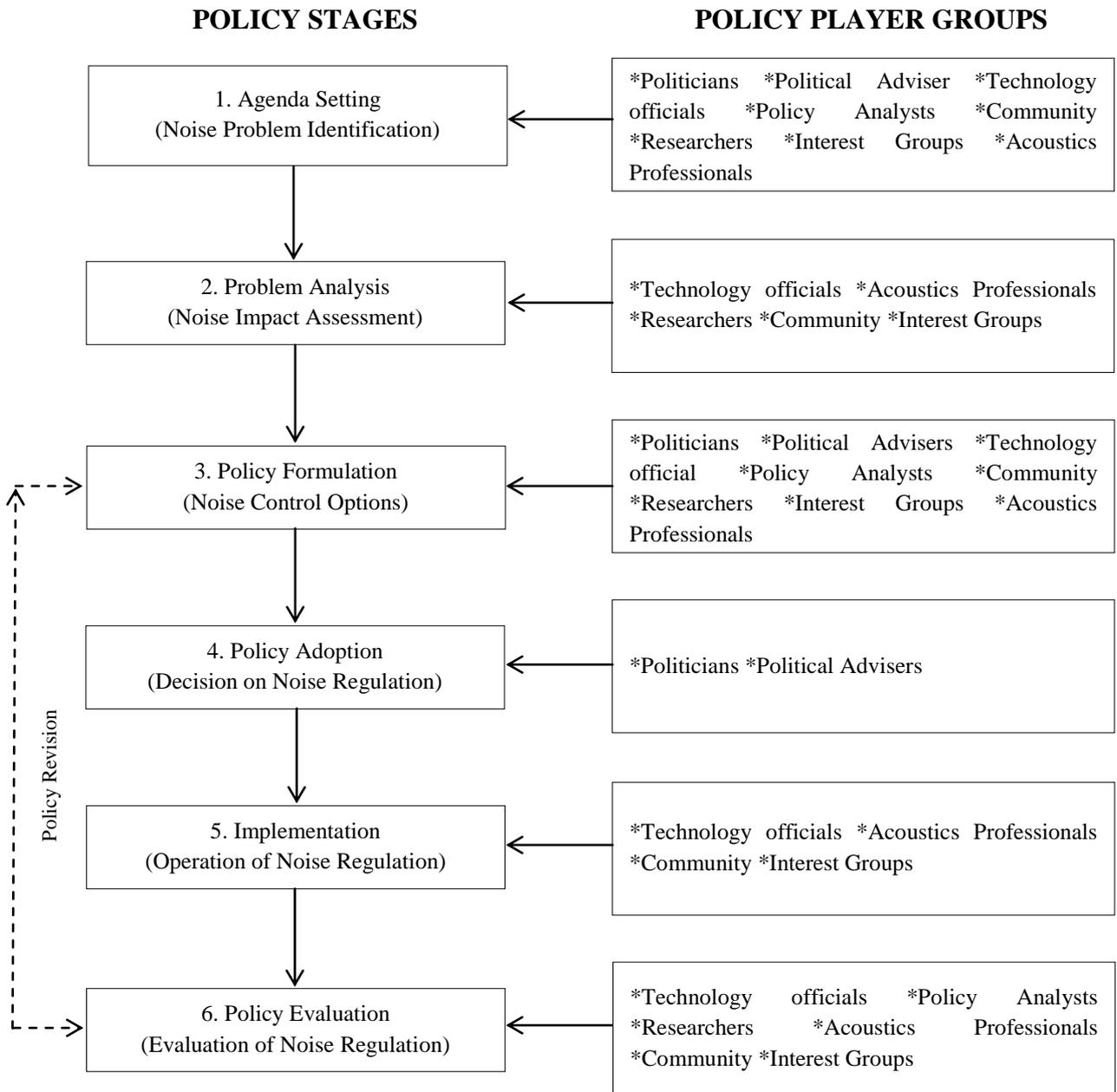
- i. The precautionary principle - In all cases, noise should be reduced to the lowest level achievable in a particular situation. Where there is a reasonable possibility that public health will be damaged, action should be taken to protect public health without awaiting full scientific proof.
- ii. The polluter pays principle - The full costs associated with noise pollution (including monitoring, management, lowering levels and supervision) should be met by those responsible for the source of noise.
- iii. The prevention principle - Action should be taken where possible to reduce noise at the source. Land-use planning should be guided by an environmental health impact assessment that considers noise as well as other pollutants.

The government policy framework is the basis of noise management. Without an adequate policy framework and adequate legislation it is difficult to maintain an active or successful noise management program. A policy framework refers to transport, energy, planning, development and environmental policies. The goals are more readily achieved if the interconnected government policies are compatible, and if issues which cross different areas of government policy are coordinated (World Health Organization - Guidelines for Community Noise, 1999).

2.5.1 Stages in Noise Management

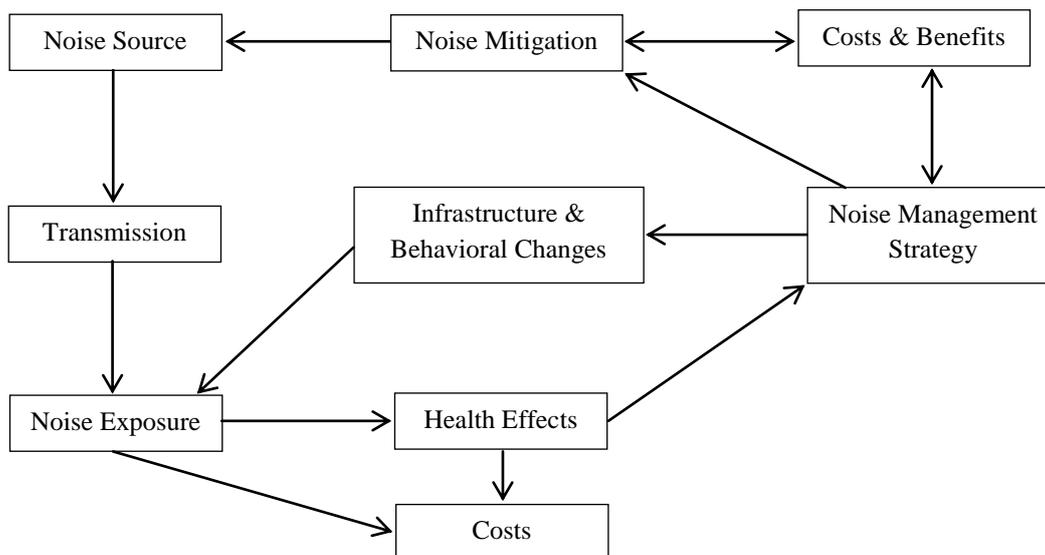
A legal framework is needed to provide a context for noise management (Finegold 1998; Hede 1998a). Model in figure (2.1) depicts the six stages in the process for developing and implementing policies for community noise management. For each policy stage, there are groups of 'policy players' who ideally would participate in the process. When goals and policies have been developed, the next stage is the development of the strategy or plan. Figure (2.2) summarizes the stages involved in the development of a noise management strategy and specific abatement measures are listed in Table (2.3) (World Health Organization - Guidelines for Community Noise, 1999).

Figure (2.1) A model of the policy process for community noise management(Hede 1998a)



Source: World Health Organization - Guidelines for Community Noise, 1999.

Figure (2.2) Stages involved in the development of a noise abatement strategy



Source: World Health Organization - Guidelines for Community Noise, 1999.

Table (2.3) Recommended Noise Management Measure (following EEA 1995)

Legal Measure	Examples
Control of noise transmission	Regulations on sound-obstructive measures
Noise mapping and zoning around roads, airports, industries	Initiation of monitoring and modeling programs
Control of noise emissions	Limits for exposure levels such as national emission standards; noise monitoring and modeling; regulations for complex noise situations; regulations for recreational noise
Speed limits	Residential areas; hospitals
Enforcement of regulations	Low Noise Implementation Plan
Minimum requirements for acoustical properties of buildings	Construction codes for sound insulation of building parts

Table (2.3) Recommended Noise Management Measure (following EEA 1995)
(cont'd)

Engineering Measures	
Emission reduction by source modification	Tire profiles; low-noise road surfaces; changes in engine properties
New engine technology	Road vehicles; aircraft; construction machines
Transmission reduction	Enclosures around machinery; noise screens
Orientation of buildings	Design and structuring of tranquilly uses; using buildings for screening purposes
Traffic management	Speed limits; guidance of traffic flow by electronic means
Passive protection	Ear plugs; ear muffs; insulation of dwellings; façade design
Implementation of land-use planning	Minimum distance between industrial, busy roads and residential areas; location of tranquility areas; by-pass roads for heavy traffic; separating out incompatible functions
Education and information	
Raising public awareness	Informing the public on the health impacts of noise, enforcement action taken, noise levels, complaints
Monitoring and modeling of soundscapes	Publication of results
Sufficient number of noise experts	University or high-school curricula
Initiation of research and development	Funding of information generation according to scientific research needs
Initiation of behavior changes	Speed reduction when driving; use of horns; use of loudspeakers for advertisements

Source: World Health Organization - Guidelines for Community Noise, 1999.

The process outlined in Figure (2.2) can start with the development of noise standards or guidelines. It should also involve the identification and mapping of noise sources and exposed communities. Meteorological conditions and noise levels would also normally be monitored. These data can be used to validate the output of models that estimate noise levels. Noise standards and model outputs may be considered in devising noise control tactics aimed at achieving the noise standards. Before being enforced, current control tactics need to be revised, and if the standards are achieved they need continued enforcement. If the standards are not achieved after a reasonable period of time, the noise control tactics may need to be revised (World Health Organization - Guidelines for Community Noise, 1999).

2.5.2 Noise Control Approaches

An integrated noise policy should include several control procedures: measures to limit the noise at the source, noise control within the sound transmission path, protection at the receiver's site, land-use planning, education and rising of public awareness.

Mitigation measures:The most effective mitigation measure is to reduce noise emissions at the source. Therefore, regulations with noise level limits for the main noise sources should be introduced.

- a) Road traffic noise - Limits on the noise emission of vehicles have been introduced in many countries (Sandberg 1995). Besides these limits a special class of "low noise trucks" has been introduced in Europe. These trucks follow state-of-the-art noise control and are widely used in Austria and Germany (Lang 1995). This use is encouraged by economic incentives; for example, low-noise trucks are excepted from a night-time ban on certain routes, and their associated taxes are lower than for other trucks. However, the main noise from traffic on highways is rolling noise. This may be reduced by quiet road surfaces or by selection of quiet tires.

Road traffic noise may also be reduced by speed limits, provided the limits are enforced. Decreasing the speed of cars from 140 to 100 km/h would result in the same noise reduction (WHO 1995a). Noise emission from road traffic may be further reduced by a night-time ban for all vehicles, or especially for heavy vehicles. Traffic management designed to ensure uniform traffic flow in towns also serves to reduce noise. "Low-noise

behavior” of drivers should be encouraged as well, by advocating defensive driving manners. The unnecessary use of horns within cities should be forbidden, especially during night-time, and this rule should be enforced.

- b) Railway noise and noise from trams - The main noise sources are the engine and the wheel-rail contact. Noise at the source can be reduced by well-maintained rails and wheels, and by the use of disc brakes. Replacement of steel wheels by rubber wheels could also reduce noise from railways and trams substantially. Other measures include innovations in engine and track technology (Moehler 1988; Öhrström&Skånberg 1996).
- c) Aircraft noise - The noise emission of aircraft is limited by ICAO Annex 16(The International Civil Aviation Organization), which estimates maximum potential sound emissions under certification procedures (ICAO 1993). The use of low-noise aircraft may also be encouraged by setting noise-related charges. Night-time aircraft movements should be discouraged where they impact residential communities. Particular categories of aircraft (such as helicopters, rotorcraft and supersonic aircraft) pose additional problems that require appropriate controls (EU 1980; EU 1989).
- d) Machines and Equipment - Noise emission has to be considered a main property of all types of machines and equipment. The introduction of sound labeling is a major tool for reducing the noise emission of products on the market (EU 1984a-f; EU 1986b,c). A second step would be the introduction of limits on the sound power levels for certain groups of machines, heating and ventilation systems (e.g. construction machines, household appliances). These limits may be set by law, in recommendations and by consumers.
- e) Noise control within the sound transmission path - The installation of noise barriers can protect dwellings close to the traffic source. In several European countries noise barrier regulations have been established (WHO 1995b), but in practice they are often not adequately implemented. These regulations must define:
 - i. Measuring and calculation methods for deriving the equivalent sound pressure level of road or railway traffic, and schemes for determining the effectiveness of the barrier.
 - ii. The sound pressure limits that are to be achieved by installing barriers.

- iii. The budgetary provisions.
 - iv. The responsible authority.
- f) Noise protection at the receiver's site - This approach is mainly used for existing situations. However, this approach must also be considered for new and for old buildings in noisy areas. Residential buildings near main roads with heavy traffic, or near railway lines, may be provided with sound-proofed windows.

Precautionary measures: With careful planning, noise exposure can be avoided or reduced. For new buildings, standards or building codes should describe the positions of houses, as well as the ground plans of houses with respect to noise sources. The required sound insulation of the facades should also be described.

- a) Land use planning - Land use planning is one of the main tools for noise control and includes:
- i. Calculation methods for predicting the noise impact caused by road traffic, railways, airports, industries and others.
 - ii. Noise level limits for various zones and building types. The limits should be based on annoyance responses to noise.
 - iii. Noise maps or noise inventories that show the existing noise situation. The construction of noise-sensitive buildings in noisy areas, or the construction of noisy buildings in quiet areas may thus be avoided.

Suggestions on how to use land use planning tools are given in several dedicated books (e.g. Miller & de Roo 1997). Different zones, such as quiet areas, hospitals, residential areas, commercial and industrial districts, can be characterized by the maximum equivalent sound pressure levels permissible in the zones.

It is recommended that countries should adopt the precautionary principle in their national noise policies. This principle should be applied to all noise situations where adverse noise effects are either expected or possible, even when the noise is below standard values.

Education and public awareness: Noise abatement policies can only be established if basic knowledge and background material is available, and the people and authorities are aware that noise is an environmental hazard that needs to be controlled. Therefore, it is necessary to include noise in school curricula and to establish scientific institutes to study acoustics and noise control. People working in such institutes should have the option of studying in other countries and exchanging

information at international conferences. Dissemination of noise control information to the public is an issue for education and public awareness. National and local advisory groups should be formed to promote the dissemination of information, to establish uniform methods of noise measurement and impact assessment, and to participate in the development and implementation of educational and public awareness programs (World Health Organization - Guidelines for Community Noise, 1999).

2.5.3 Analysis of the impact of environmental noise

The concept of an environmental noise impact analysis (ENIA) is central to the philosophy of managing environmental noise. An ENIA should be required before implementing any project that would significantly increase the level of environmental noise in a community. The first step in performing an ENIA is to develop a baseline description of the existing noise environment. Next, the expected level of noise from a new source is added to the baseline exposure level to produce the new overall noise level. If the new total noise level is expected to cause an unacceptable impact on human health, trade-off analyses should then be performed to assess the cost, technical feasibility and community acceptance of noise mitigation measures. It is strongly recommended that countries should develop standardized procedures for performing ENIAs (Finegold et al. 1998; SABS 1998).

Assessment of adverse health effects: In setting noise standards, the adverse health effects from which the population is to be protected need to be defined. Health effects range from hearing impairment to sleep disturbance, speech interference to annoyance. The difference between adverse and non-adverse effects sometimes causes considerable difficulties. More serious noise effects are generally accepted as adverse. Consideration of health effects that are both temporary and reversible requires a judgement on whether these less-serious effects should be considered when deriving guideline values. Judgements as to the adversity of health effects may differ between countries, because of factors such as cultural backgrounds and different levels of health status.

Estimation of the population at risk: The population at risk is that part of the population in a given country or community that is exposed to enhanced levels of noise. Each population has sensitive groups or subpopulations that are at higher risk of developing health effects due to noise exposure. Sensitive groups include

individuals impaired by concurrent diseases and those with specific characteristics that make them more vulnerable to noise. The sensitive groups in a population may vary across countries due to differences in medical care, nutritional status, lifestyle and demographic factors, prevailing genetic factors, and whether endemic or debilitating diseases are prevalent.

Calculation of exposure-response relationships:In developing standards, regulators should consider the degree of uncertainty in the exposure-response relationships provided in the noise guidelines. Differences in the population structure, climate and geography can influence the prevalence and severity of noise-related health effects. In consequence, modified exposure-response relationships may need to be applied when setting noise standards.

Assessment of risks and their acceptability:In the absence of distinct thresholds for the onset of health effects, regulators must determine what constitutes an acceptable health risk for the population and select an appropriate noise standard to protect public health. The acceptability of the risks involved will depend on several factors, such as the expected incidence and severity of the potential effects, the size of the population at risk, the perception of related risks, and the degree of scientific uncertainty that the effects will occur at any given noise level.

The acceptability of risk may vary among countries because of differences in social norms, and the degree of adversity and risk perception by the general population and stakeholders. Risk acceptability is also influenced by how the risks associated with noise compare with risks from other pollution sources or human activities (World Health Organization - Guidelines for Community Noise, 1999).

2.5.4 Cost-benefit analysis

In the derivation of noise standards from noise guidelines, two different approaches for decision making can be applied. Decisions can be based purely on health, cultural and environmental consequences, with little weight to economic efficiency. This approach has the objective of reducing the risk of adverse noise effects to a socially acceptable level. The second approach is based on a cost-benefit analysis (CBA). The objective is to identify control actions that achieve the greatest net economic benefit. The development of noise standards should account for both extremes, and involve stakeholders and assure social equity to all the parties involved. It should also provide sufficient information to guarantee that stakeholders understand

the scientific and economic consequences. To determine the costs of control action, the abatement measures used to reduce emissions must be known. Costs of action should include all costs of investment, operation and maintenance.

The steps in a cost-benefit analysis include:

- i. The identification and cost analysis of control action (such as emission abatement strategies and tactics).
- ii. An assessment of noise and population exposure, with and without the control action.
- iii. The identification of benefit categories, such as improved health and reduced property loss.
- iv. A comparison of the health effects, with and without control action.
- v. A comparison of the estimated costs of control action with the benefits that accrue from such action.
- vi. A sensitivity and uncertainty analysis.

Action taken to reduce one pollutant may increase or decrease the concentration of other pollutants. These additional effects should be considered, as well as pollutant interactions that may lead to double counting of costs or benefits, or to disregarding some costly but necessary action. Due to different levels of knowledge about the costs of control action and health effects, there is a tendency to overestimate the cost of control action and underestimate the benefits.

CBA is a highly interdisciplinary task. Appropriately applied, it is a legitimate and useful way of providing information for managers who must make decisions that impact health. CBA is also an appropriate tool for drawing the attention of politicians to the benefits of noise control. In any case, a CBA should be peer-reviewed and never be used as the sole and overriding determinant of decisions (World Health Organization - Guidelines for Community Noise, 1999).

2.6 Reviews on Previous Studies

“Evaluation of the People Perception on Major Noise Source and its Impact on Health at Dire Dawa City, Ethiopia” (Zerihun, Mamo, Sitotaw, & Mengistu, 2017) study focuses on the people perception on major noise source and its impact on people health. One of the major findings of this study was that people perceptions of noise pollution do not depend on the intensity level of sound, but merely on the people’s interest for that sound. This study recommended that noise protection

programs and legal frames should be designed by the city administration and public discussions on noise sources and adverse effects should be done in a regular manner to create and increase awareness of the people.

“Urban Environmental Noise Pollution and Perceived Health Effects in Ibadan, Nigeria” (Olorunfoba, Ademola, Sridhar, Agbola, Omokhodion, Ana, & Alabi, 2012) research article examined the sources and noise levels and possible impacts in Ibadan, Nigeria. This research article focuses to assess the sources and noise levels, and possible impacts in selected residential neighborhoods of Ibadan metropolis. This research article advised that there is a need for formulation and enforcement of permissible noise levels/standards for residential neighborhoods by the Federal Ministry of Environment instead of using the current eight-hour standard of 90dB which is for industrial settings.

“Noise Pollution - Sources, Effects and Control” (Singh & Davar, 2004) explored the sources, effects, reactions and suggestions for controlling the excessive noise. This study founded out that automobiles and loudspeakers turns out to be major sources of noise pollution and noise affects individuals in several ways. This study stated that public education appears to be the best methods as suggested by the respondents. However, government and NGOs can play a significant role in the process.

“Perceived Health Effects of Environmental Noise Pollution on the Inhabitants of Ado-Ekiti Metropolis, Ekiti State, Nigeria” (Awosusi & Olusola, 2014) study investigated the level of awareness of health problems associated with noise pollution and also examined the relationship between location and the perceived health effects among inhabitants of Ado Ekiti metropolis. This study founded out that a significant relationship was found to exist between level of educational attainment and knowledge of health effect of environmental noise pollution. Further analysis revealed that respondents with tertiary education demonstrated the highest knowledge of the health effects could be attributed to the possibility of knowledge gained at school or exposure to information. This study recommended that as a matter of urgency, government should review the existing noise pollution regulatory laws and ensure compliance with the activities put in place to control noise in living areas and health educators should organize sensitization programs to educate the populace on the health effects of noise pollution.

CHAPTER III
ENVIRONMENTAL NOISE POLICY AND REGULATION
IN SELECTED COUNTRIES

3.1 Myanmar

Yangon City Development Committee (YCDC) law (2018), sub-section (a) of section 322 provides that if doing activities that cause either land, air, water and noise pollution; activities that harm environment, shall be punished with fine from one hundred thousand to five hundred thousand or a sentence of imprisonment for three months or shall be punished both and it shall be punished a sentence of imprisonment for six months if reoffend.

The National Environmental Quality (Emission) Guidelines (2015) by Ministry of Environmental Conservation and Forestry states guidelines for noise as following; any activities producing noise must be prevent and reduce if the noise exceed or expected to exceed the maximum acceptable noise level. The acceptable noise levels are as follow:

Table (3.1) Acceptable Noise Levels

Type of Area	Maximum permitted noise levels (reckoned as the equivalent noise level over 1 hour) in decibels (dBA)	
	Day - Time 07:00 – 22:00 (10:00 – 22:00 for Public holidays)	Night – Time 22:00 – 07:00 (22:00 – 10:00 for Public holidays)
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

Source: The National Environmental Quality (Emission) Guidelines

Moreover, anyone can complain to the ward or village administrative office or police station if the neighborhood makes so much noise that cause nuisance.

3.1.1 Loudspeaker

Social occasions of joy and grief, charity shows, weddings, traditional ceremonies and sale promotions across Myanmar widely use loudspeakers. Some of the ceremonies open loudspeaker very loudly with no time limit, which cause some people living near the ceremonies uncomfortable. Ward or Village Tract Administrator has the responsibility to control the use of loudspeaker. Ceremonies need permission from ward or Village Tract Administrator to use loudspeaker.

The ward or village tract administration law sub-section (i) of section 13 provides the functions and duties of the ward or village tract administrator about the use of loudspeaker as – to grant the request of permit to switch on loudspeaker with stipulated terms and conditions, to take action and to inform to take action the person who switches on loudspeaker without permission or the person who breaches the terms and conditions. Section 18 states that if the person residing in the ward or village tract desires to switch on the loudspeaker, he shall obtain the permit from the relevant ward or village tract administrator and also comply with the stipulated terms and conditions. Section 27 states that whoever fails to carry out duty contained in sections 18 shall be punished with fine not exceeding five thousand kyats. If default to pay the fine, he shall be punished with imprisonment not exceeding seven days by the relevant court.

The ward or village tract administration by-law sub-section (c) of section 14 states the permission concerning with the use of loudspeakers as:

1. Concerning the individual or organization intending to operate the loudspeaker, or concerning the owner of the loudspeaker intending to rent the item, a request for usage containing information on the reason, time and date for using the loudspeaker should be submitted at least 3 days in advance.
2. Upon receiving the necessary documents outlined in sub-section (1) necessary arrangements should be made while pertaining to:
 - (i) Loudspeaker usage should normally be permitted between 6 am to 9 pm.
 - (ii) To prevent public nuisance, usage should be limited to the permitted vicinity or front of a building for the public to hear.
 - (iii) Ensuring usage is limited for the intended purpose written in the request document.
 - (iv) Ensuring adherence to the responsible official's decision to end usage of the loudspeaker.

3. Procuring any required documents from the police station if necessary.
4. Ensuring adherence to the rules, regulations and guidelines issued by the department or organization concerned.

Myanmar Parliament also states that; when using loudspeakers as permitted within the boundary of the relevant laws and by-laws, the following rules must be respected:

- (i) Avoid disturbing public peace and workplaces.
- (ii) The loudspeaker must only be operated within the permitted hours of the day, and not beyond. (Ensure the use of loudspeakers does not go against the rules or ethics of public spaces. E.g. ensuring classrooms are not affected in during school hours; ensuring patients in hospitals are not annoyed.)
- (iii) The loudspeaker must only be operated within the permitted timeframe or number of days.
- (iv) The loudspeaker must only be operated within the permitted premises.
- (v) Ensure material played or spoken through the loudspeaker does not harm or degrade any persons, organizations, national security or religious groups.
- (vi) Allow relevant officials to come inspect at their discretion.
- (vii) The permission granted for the use of the loudspeaker may be revoked at any time by those responsible when they deem to do so necessary.

3.1.2 Vehicular Noise Control

The ban on using car horns was first implemented in six main townships in the city starting from May 2003. According to the Yangon Region Traffic Police Department (YGTP), the zone was later extended to all townships administrated by Yangon City Development Committee in October the same year. However, it can be said that the ban on using car horns is a failure because most of the people still use car horns even if it is unnecessary. Moreover, the confiscation of vehicles fitted with power exhausts has begun at the end of 2014. Yangon regional and traffic police seized offending vehicles and were also fined one thousand and five hundred kyats and suspended the drivers' licenses for a month. They were forced to sign a pledge not to repeat the offence, and faced the loss of their license for the six months if they reoffended. Yangon traffic police returned the seized offending vehicles to their owners, with the power exhaust removed, depending on the date of seizure.

Motor Vehicle Law (2015) sub-section (g) of section 54 prohibited that changing, without legal permission or reasons backed up by evidence, the original type of a vehicle, its main parts, or the facts in a motor vehicle inspection certificate and sub-section (h) of section 54 prohibited that driving a motor-cycle without back mirror or silencer over the shock absorber. Section 62 provides that anyone found to have broken the prohibition of section 54 will be punished with a fine of not more than thirty thousand kyats. However, there are still many vehicles fitted with power exhausts probably because the penalties are not harsh enough.

3.2 Cambodia

The management of noise pollution in Cambodia is governed by Sub-Decree on Air Pollution Control and Noise Disturbance (2000). Chapter 2 of Sub-Decree states the provisions on emission of air and noise pollution. Article 11 under this chapter provides that the importation utilization, vehicle and its spare-part production in Cambodia which emitted pollutants and noise exceeding the standard shall be strictly prohibited. Chapter 3 states about the asking for permission about pollution. Article 13 under that chapter provides that the emission of pollutants and noise from immovable source into the atmosphere shall be asked for a permission from the Ministry of Environment and shall be sent the application from copy to concerned ministries and agencies.

Chapter 4 states about pollution source monitoring and article 17 under this chapter provides that the monitoring of flammable substance's quantity, air pollutant emission and noise causing from immovable source is the responsibility of the Ministry of Environment. Article 18 provides that the monitoring of smoke and noise emission from movable source is the responsibility of the Ministry of Environment in collaboration with line ministries and institution. The monitoring procedure shall be determined by joint declaration among line ministries. Article 19 also states that Ministry of Environment shall be prepared technical guidelines on pollution source monitoring sampling point, air and noise analysis.

Article 24 states that the owner or responsible person of pollution source shall responsible for installing or equipping any equipment to purify toxic substances and to reduce noise and vibration in order to respond to Air pollution standard, responsible for installing the equipment for measurement of amount of pollutant contained in his/her pollution sources and keep the result for record keeping. The result must send

to the Ministry of Environment every 3 months, have at least an environmental compromising and prepare environmental protection plan in their institution. Environmentalist shall listed and recognized from the Ministry of Environment and have the capability as required by the Ministry of Environment.

Article 25 states that even if it is found out that the discharge of toxic substances and noise from any pollution source do not respond to the standard, the Ministry of Environment shall issue a written order requiring the owner or responsible person of such pollution source to correct the violation activities immediately within a specifies time period, issue are written order requiring the owner of responsible person of such pollution source to stop his/her activities temporarily until the violation is corrected if the violation activities cause an adverse impact to human health and air quality.

Chapter 7 of this sub-decree states about the penalty. Article 34 under this chapter provides that the Ministry of Environment’s official is responsible for making a report of prosecution for any person who violate any article of this sub-decree. The Ministry of Environment shall take legal action against any offense of this sub-decree. Article 35 also states that any environmental inspection official or agent who is negligent, fails to pay attention to fails to comply with the Ministry’s regulations or conspires with a violator or facilitates the commission of a violation shall be subject to administrative sanction or face prosecution before the court.

The standard for noise emission from various resources like vehicle and for maximum noise emission for public and residential areas is shown in the Table (3.2) and Table (3.3).

Table (3.2) Vehicle of noise in public and residential area maximum permitted noise level

No	Category of vehicle	Maximum noise level permitted (dBA)
1	Motorcycle, cylinder capacity (cc) of the engine does not exceed 125 cm ³	85
2	Motorcycles, cc of the engine exceeds 125 cm ³	90
3	Motorize tricycles	90
4	Cars, taxi, passenger vehicle for the carriage of dose not more than 12 passengers	80

Table (3.2) Vehicle of noise in public and residential area maximum permitted noise level (cont'd)

5	Passenger vehicle constructed for carriage of more than 12 passengers	85
6	Truck permitted maximum weight does not exceed 3.5 tones	85
7	Truck permitted maximum weight exceed 3.5 tones	88
8	Truck engine is more than 150 KW	89
9	Tractor or any other truck not elsewhere classified of described in this column of the table	91

Remark: This standard is applied to control of noise emission standard for all kind of vehicle when operating on the public road.

Source: Sub-Decree on Air Pollution Control and Noise Disturbance (2000).

Table (3.3) Maximum permitted noise level in public and residential area (dBA)

No	Area	Period of time		
		6 am - 6 pm	6 pm - 10 pm	10 pm - 6 am
1	Quiet areas - Hospitals - Libraries - School - Kindergarten	45	40	35
2	Residential area: - Hotels - Administration offices - House	60	50	45
3	Commercial and service areas mix	70	65	50
4	Small industrial industries intermingling in residential areas	75	70	50

Remark: This standard is applied to control of noise level of any source of activity that emitted noise into the public and residential areas.

Source: Sub-Decree on Air Pollution Control and Noise Disturbance (2000).

3.3 India

In India, the noise pollution is managed under the Environment (Protection) Act, 1986, the Government of India came up with the Noise Pollution (Regulation and Control) Rules in the year 2000 that were amended a few times later. Sub-rule (2) of section 3 of these rules states that the State Government shall categorize the areas into industrial, commercial, residential or silence areas/zones for the purpose of implementation of noise standards for different areas (shown in Table 3.4).

Table (3.4) Ambient Noise Standards

Area Code	Category of Area/Zone	Limits in dBA _{Leq}	
		Day Time	Night Time
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

Source: The Noise Pollution (Regulation and Control) Rules, 2000

3.3.1 Restrictions on the use of Loudspeakers/Public Address System and Sound Producing Instruments

Section 5 of the Noise Pollution (Regulation and Control) Rules, 2000 lay down the restrictions on the use of loudspeakers, public address systems and sound producing instruments. These rules lay down the following five restrictions on the use of loud speakers and other sound producing instruments.

1. A loudspeaker or a public address system shall not be used except after obtaining written permission from the authority.
2. A loud speaker or a public address system or any sound producing instrument or a musical instrument or a sound amplifier shall not be used at night time except in closed premises for communication within, like auditoria, conference rooms, community halls, banquet halls or during a public emergency.
3. Notwithstanding anything contained in sub-rule (2), the State Government may subject to such terms and conditions as are necessary to reduce noise pollution, permit use of loudspeakers or public address systems and the like during night hours between 10:00 pm to 12:00 midnight on or during

any cultural or religious festive occasion of a limited duration not exceeding fifteen days in all during a calendar year. The Concerned State Government shall generally specify in advance, the number and particulars of the days on which such exemption would be operative.

4. The noise level at the boundary of the public place, where loudspeaker or public address system or any other noise source is being used shall not exceed 10 dBA above the ambient noise standards for the area or 75 dBA whichever is lower.
5. The peripheral noise level of a privately owned sound system or a sound producing instrument shall not, at the boundary of the private place, exceed by more than 5 dBA the ambient noise standards specified for the area in which it is used.

3.3.2 Restrictions on the use of Horns, Sound Emitting Construction Equipment and Bursting of Fire Crackers

Section 5A of the Noise Pollution (Regulation and Control) Rules, 2000 lay down the restrictions on the use of horns, sound emitting construction equipment and bursting of fire crackers as follow –

1. No horn shall be used in silence zones or during night time in residential areas except during a public emergency.
2. Sound emitting fire crackers shall not be burst in silence zone or during night time.
3. Sound emitting construction equipment shall not be used or operated during night time in residential areas and silence zones.

3.3.3 Consequences of any Violation in Silence Zone/Area

Section 6 of the Noise Pollution (Regulation and Control) Rules, 2000 states that whoever, in any place covered under the silence zone/area commits any of the following offence, he shall be liable for penalty under the provisions of the Act:-

- i. whoever, plays any music or uses any sound amplifiers,
- ii. whoever, beats a drum or tom-tom or blows a horn either musical or pressure, or trumpet or beats or sounds any instrument,
- iii. whoever, exhibits any mimetic, musical or other performances of a nature to attract crowds,

- iv. whoever, bursts sound emitting fire crackers; or
- v. whoever, uses a loudspeaker or a public address system.

3.3.4 Complaints to be made to the Authority

Section 7 of the Noise Pollution (Regulation and Control) Rules, 2000 lays down the following.

1. A person may, if the noise level exceeds the ambient noise standards by 10 dBA or more given in the corresponding columns against any area/zone or, if there is a violation of any provision of these rules regarding restrictions imposed during night time, make a complaint to the authority.
2. The authority shall act on the complaint and take action against the violator in accordance with the provisions of these rules and any other law in force.

3.3.5 Power to Prohibit Continuance of Music Sound or Noise

Section 8 of the Noise Pollution (Regulation and Control) Rules, 2000 states the power to prohibit etc. continuance of music sound or noise as following.

1. If the authority is satisfied from the report of an officer in charge of a police station or other information received by him, including from the complainant that it is necessary to do so in order to prevent annoyance, disturbance, discomfort or injury or risk person who dwell or occupy property on the vicinity, he may, by a written order issue such directions as he may consider necessary to any person for preventing, prohibiting, controlling or regulating:-
 - a) The incidence or continuance in or upon, any premises of –
 - i. Any vocal or instrumental music,
 - ii. Sounds caused by playing, beating, clashing, blowing or use in any manner whatsoever of any instrument including loudspeakers, public address systems, horn, construction, equipment, appliance or apparatus or contrivance which is capable of producing or reproducing sound,
 - iii. Sound caused by bursting of sound emitting fire crackers, or
 - b) The carrying on in or upon, any premises of any trade, a vocation or operation or process resulting in or attended with noise.
2. The authority empowered under sub-rule (1) may, either on its own motion, or on the application of any person aggrieved by an order made under sub-rule (1), either rescind, modify or alter any such order:

Provided that before any such application is disposed of, the said authority shall afford to the applicant and to the original complainant, as the case may be and opportunity of appearing before it either in person or by a person representing him and showing cause against the order and shall, if it rejects any such application either wholly or in part, record its reasons for such rejection.

Note:-

- i. Day time shall mean from 6:00 am to 10:00 pm.
- ii. Night time shall mean from 10:00 pm to 6:00 am.
- iii. Silence zone is an area comprising not less than 100 meters around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.
- iv. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

CHAPTER IV

SURVEY ANALYSIS

4.1 Survey Profile

Kamayut Township is located in the north central part of Yangon. It is situated between North Latitude 16° 48' and 16° 15', and East Longitude 96° 06' and 96° 08'. It is approximately situated at elevation 50 feet above sea level. It comprises ten wards (ward 1 to ward 10) and the total area is 2.4 square miles with 0.5 mile from East to West and 1.25 mile from North to South. Kamayut is the one of the most prosperous areas in Yangon and it is also "college town" of the Yangon. Pyay Road which cuts across the township is lined with many education and media related institutions, such as Myanmar Radio and Television headquarters. Yangon University, the University of Medicine 1, Yangon, the Yangon University of Economics, the University of Distance Education, Yangon, Yangon University of Foreign Language, Yangon University of Education, Yangon Institute of Marine Technology and the private university named Strategy First are all located in the township.

Historic buildings in Kamayut Township are Yangon University, Judson Chapel church, Diamond Jubilee Hall and Drug eliminating museum. The township has six high schools, one middle school, eleven primary school and three monastic schools. There are a total of seven hospitals in this township. Sinhmalike Market, formerly Kunchan Market and Hledan Market are the township's primary markets. Kamayut Township is also home to these shopping mall named Junction Square, Sein Gay Har, Hledan Center and San Yeik Nyein Gamome Pwint. Another famous place in this township is a place named Hledan. Since this place is a hub for public transportation, having so many classes relating to education, varieties of shops and foods with reasonable price, it is well known, especially among youth. The township share borders with Bahan Township in the East, Seikkan Township and Hlaing River in the West, Kyimyindaing Township and Sanchaung Township in the South and Mayangon Township and Hlaing Township in the North. The following tables show the information regarding to population in Kamayut Township.

Table (4.1) Demographic Characteristics of Kamayut Township

		Total	Percentage (%)	
Number of Household		4,384	100	
Number of Family Household		17,956	100	
Population	Male	38,671	47.6	
	Female	42,566	52.4	
	Total	81,237	100	
Population of Religion				
Buddhism	Christianity	Hinduism	Islam	Total
77,778	3,392	59	8	81,237

Source: Kamayut Township General Administration Department (2018)

According to the Table (4.1), there are 4,384 households, 17,956 families with a total populations of 81,237 are living in Kamayut Township. There are 38,671 male and 42,566 female in the total population. So, the number of female is higher than the number of male in Kamayut Township. There are 77,778 Buddhism, 3,392 Christianity, 59 Hinduism and 8 Islam in this township. From this it can be seen that majority of people in Kamayut Township are Buddhism.

4.1.1 Survey Profile of Ward (5), Ward (6) and Ward (7)

Ward (5), (6) and (7) are located in the West and South-West of the Kamayut Township. Area of ward (7) is the largest among three wards; follow by ward (5) and ward (6), and ward (5) is the most populated and ward (6) is the least. Ward (5) is located near the Yangon River. Ward (6) has one railway station; Hledan Station. In term of religious buildings and structures, ward (5) has one monastery, seven community halls for religious purposes; ward (6) has two monasteries and four community halls for religious purposes and ward (7) has two monasteries and two community halls for religious purposes. There are no other religious buildings and structures in these three wards.

In term of education sector, there are one High School (public) and one private school in ward (6) and one Primary School in ward (7), but there are no monastic educations in these wards. In term of health sector, private hospital Grand Hantha is located in ward (6) but there are no hospitals in both ward (5) and (7). There is a large market named; Sin Ma Lite Market in ward (6). Unlike ward (5) and (6), ward (7)

have one shopping mall; named Junction Square, one museum; Drug Elimination Museum and one petrol filling station: Max Energy Myanmar. The following tables show the population information and population of religion in ward (5), (6) and (7).

Table (4.2) shows the information regarding to population of ward (5), (6) and (7). There are 380 households, 1,167 families with a total population of 6,944 are living in ward (5). There are 3,240 male and 3,704 female in the total population. It can be seen that the number of female is higher than the number of male in this ward. There are 6,618 Buddhism and 326 Christianity but no Hinduism and Islam in this ward. It can be seen that majority of people living in this ward are Buddhism.

In ward (6), 73 households, 978 families with a total population of 4,509, male 2,206 and female 2,303, are living. The number of male is lower than the female in this ward. There are no Hinduism and Islam in this ward but there are 4,244 Buddhism and 265 Christianity. It can be seen that majority of people living in this ward are also Buddhism.

In ward (7), 117 households, 1,013 families with a total population of 4,534, male 2,230 and female 2,304, are living. In this ward, the number of male is lower than the female. The majority of people living in this ward are Buddhism with 4,380 people and there are 154 Christianity. There are no Hinduism and Islam in this ward.

Table (4.2) Demographic Characteristics of Ward (5, 6, 7)

		Ward 5	Ward 6	Ward 7	
Number of Household		380	73	117	
Number of Family Household		1,167	978	1,013	
Total Population	Male	3,240	2,206	2,230	
	Female	3,704	2,303	2,304	
	Total	6,944	4,509	4,534	
Population of Religion					
Ward	Buddhism	Christianity	Hinduism	Islam	Total
5	6,618	326	-	-	6,944
6	4,244	265	-	-	4,509
7	4,380	154	-	-	4,534

Source: Kamayut Township General Administration Department (2018)

4.2 Survey Design

The survey was conducted in ward 5, 6 and 7 of Kamayut Township from March to April, 2019. There are 10 wards in Kamayut Township and three wards were selected by using simple random sampling method. A total of 150 random samples were chosen proportionately among three wards. The purposes of choosing Kamayut Township are because this township is located in the downtown urban area with relatively high population and is the public transportation hub; the environmental noise in this township is considered to be high.

The structured questionnaire was constructed to consist of four main parts. The first section, question number 1 to 8, was to obtain the demographic characteristics of the respondents. The second section, question number 9 to 13, was about the noise pollution in respondent's neighborhood. The third section, question number 14 to 17, was concerned with health effects due to noise pollution. The fourth section, question number 18 and 19, was relating with respondent's awareness on noise pollution.

4.3 Survey Results

This section discusses the results and the findings based on the analysis done on the data collected from respondents. The survey results and findings are shown in the following tables in each parts of the conducted survey.

4.3.1 Demographic Characteristics of the Respondents

Total of 150 respondents; 50 respondents from each ward (5), (6) and (7) of Kamayut Township are included to give some finding regarding the public perception on the effect of environmental noise pollution on people's health in this study.

Table (4.3) shows the result of the gender and age of respondents. As in table, male and female respondents are proportionate with 75 respondents. Among the total of 150 respondents, 9 respondents (6%) are in the age group of 19 and below, 35 respondents (23%) are in the age group of 20-29, 28 respondents (19%) are in the age group of 30-39, 32 respondents (21%) are in the age group of 40-49 and 46 respondents (31%) are in the age group of 50 and above. This shows that the majority of respondents are those in 50 and above years old. This is because many old people are likely to be at home. The least respondents are in the age group of 19 years and below because people at that age range tend to attend classes they are interested

during summer holiday. It is found out that the average age of respondent is 40.52 years old, maximum age is 82 years old and minimum age is 11 years old.

Table (4.3) Gender and Age of Respondents

Gender	Number of respondent	Percentage (%)
Male	75	50
Female	75	50
Total	150	100
Age Group		
19 and below	9	6
20 – 29	35	23
30 – 39	28	19
40 – 49	32	21
50 and above	46	31
Total	150	100
Age of Respondent (Year)		
Maximum	82	
Minimum	11	
Average	40.52	

Source: Survey Data, 2019.

According to the Table (4.4), 87 respondents (58%) are married, 57 respondents (38%) are single, 1 respondent (1%) is single and 5 respondents (3%) are widow. So, the majority of this survey respondents are married, the second highest is single and the least one is divorce. Since married respondents are highest, it can be assumed that there is a high chance of relatively high family members in one apartment.

Table (4.4) Marital Status of Respondents

Marital Status	Number of respondent	Percentage (%)
Married	87	58
Single	57	38
Divorce	1	1
Widow	5	3
Total	150	100

Source: Survey Data, 2019.

Table (4.5) Education Level of Respondents

Education Level	Number of respondent	Percentage (%)
Illiteracy	0	0
Primary School	6	4
Middle School	34	23
High School	48	32
University Student	17	11
Graduated	40	27
Post Graduated	5	3
Total	150	100

Source: Survey Data, 2019.

Table (4.5) shows the education level of respondents. As in the table, there is no respondent in illiteracy group, 6 respondents (4%) are in primary school, 34 respondents (23%) are in middle school, 48 respondents (32%) are in high school group, 17 respondents (11%) are in university student group, 40 respondents (27%) are in graduated group and 5 respondents (3%) are in post graduated group. The majority of this survey respondents' education level are in high school and there are no illiteracy respondents.

Table (4.6) Occupation of Respondents

Occupation	Number of respondent	Percentage (%)
Own Business	47	31
Government Staff	22	15
Private Staff	33	22
Government Pensioner	8	5
Student	11	7
Dependent	29	19
Total	150	100

Source: Survey Data, 2019.

As in Table (4.6), 47 respondents (31%) are doing own business, 22 respondents (15%) are government staff, 33 respondents (22%) are private staff, 8 respondent (5%) are government pensioner, 11 respondents (7%) are student and 29 respondents (19%) are dependent. The respondents number of doing own business is

the highest because they are mostly staying at home while running their own business while the survey was conducted and the least one is government pensioner.

Table (4.7) Period of Living in Current House

Year	Number of respondent	Percentage (%)
Below 1 year	16	11
1-2 years	15	10
2-5 years	14	9
5-10 years	26	17
Above 10 years	79	53
Total	150	100

Source: Survey Data, 2019.

Above Table (4.7) shows the period of respondents living in their current house. 16 respondents (11%) have been living below 1 year, 15 numbers of respondents (10%) have been living for 1 to 2 years, 14 respondents (9%) have been living for 2 to 5 years, 26 respondents (17%) have been living for 5 to 10 years and 76 numbers of respondents (53%) have been living in their current house for more than 10 years. From this it can be assumed that, since the number respondents living in their current house more than 10 years is the highest; the chances of them can bear the noise in their neighborhood can be high due to the adaptability of the noise.

Table (4.8) Respondent Perception on Neighborhood Density

Density	Number of respondent	Percentage (%)
High	86	57
Low	14	9
Moderate	50	33
Total	150	100

Source: Survey Data, 2019.

As in Table (4.8), 86 respondents (57%) of the respondents are living in high density, 14 respondents (9%) are living in low density and 50 respondents are living in average density. It can be seen that, the study area is in high density because more than half of the respondents answered that their neighborhood are in high density and the number of respondents who answered low density is the lowest.

Table (4.9) Health Condition of Respondents

Suffering from health problems	Number of respondent	Percentage (%)
Yes	26	17
No	124	83
Total	150	100

Source: Survey Data, 2019.

Table (4.9) shows the amount of respondents who are suffering from health problems and who are not. As in table, 26 respondents (17%) are suffering from health problems while 124 respondents (83%) are not.

Respondents who have been suffering from health problems answered that they are suffering from Spondylosis, Neurological Diseases, Cardiovascular Diseases, Stroke, Diabetes Mellitus, Hypertension, Cancer and Respiratory Diseases.

4.3.2 Noise Pollution in Respondent's Neighborhood

Some respondent's neighborhood is noisy and some are not. The perception of noise pollution can vary according to the living environment. However, it is also need to consider the adaptability of the respondents in that environment. Some noise in the neighborhood is not considers as a noise for the respondents who have been living in that neighborhood for a long time or who are used to it.

Table (4.10) Noise in Respondent's Neighborhood

Dose the neighborhood you are living now has noise?	Number of respondent	Percentage (%)
Yes, it always has	47	31
Sometimes has	100	67
No, it's quiet	3	2
Total	150	100

Source: Survey Data, 2019.

As in Table (4.10), 47 respondents (31%) answered that they are living in neighborhood that always has noise, 100 respondents (67%) answered that they are living in neighborhood that sometimes has noise and 3 respondents (2%) answered that they are living in quiet neighborhood. According to the data it can be said that,

many respondents do notice the noise around their neighborhood. Moreover, it can be seen that although living in the same neighborhood people can have different perception on noise, mainly because some people are used to it while some aren't.

Table (4.11) Sources of Noise in Respondent's Neighborhood

Sources of noise	Yes	Percentage (%)
Car	72	48
Train	23	15
Construction site	7	5
Boat or Ship	5	3
Market	18	12
None	3	2
Other	92	61

Source: Survey Data, 2019.

Table (4.11) has shown the sources of noise in respondent's neighborhood. According to the survey feedback, 72 respondents (48%) chose noises from car, 23 respondents (15%) chose noises from train, 18 respondents (12%) chose noises from market, 7 respondents (5%) chose noises from construction site, 5 respondents (3%) chose noises from boat or ship, 3 respondents (2%) chose none, meaning there are no sources of noise in their neighborhood and 92 respondents (61%) chose noises from other sources. As in table (4.10), there are 3 respondents living in quiet environment, thus in table (4.11), 3 respondents choose none for sources of noise in their neighborhood. The reason of the sources of noise from car is high can be assumed to be because of the increasing number of automobile owners.

The number of respondents who choose the sources of noise from other is the highest. Many respondents choose noises from people, dog, children playing, water pump motor, warehouse, community hall for religious purposes, community who accepts donations and so on. Among them the noises from people, dog and children playing is pretty high. This is because respondents are living in high density and lack of control of stray dogs.

Table (4.12) Statement of noise in respondent's neighborhood

Is the noise in your neighborhood bearable for you?	Number of respondent	Percentage (%)
Yes, it is.	80	53
No, it is not.	17	11
Sometimes	53	35
Total	150	100

Source: Survey Data, 2019.

As in Table (4.12), 80 respondents (53%) answered that the noise in their neighborhood is bearable for them, 17 respondents (11%) answered that the noise in their neighborhood is not bearable for them and 53 respondents (35%) answered that the noise in their neighborhood is sometimes bearable for them. The number of respondents who can bear the noises from their neighborhood is high because, as shown in above table (4.7), among 150 respondents 76 respondents (53%) are living more than 10 years in their current house, they are now used to the noises from their neighborhood.

According to the Table (4.13), noisiest time of the day is at night with 49 respondents in number (33%), followed by evening with 40 respondents (27%), afternoons with 28 respondents (19%), morning with 22 respondents (15%) and all day with 11 respondents (7%). Night is the noisiest time of the day because it is a time for most people to relax and people are more sensitive to noises at that time. The second highest one of the time is evening and it is found that at that time many people come back from work, students come back from school and play with their neighborhoods cause noises for some respondents. In the afternoons, noises from traffic bother people. The excessive used of car horn cause annoyance to people. Some respondents, especially who work at night are very sensitive to noises at the morning because it is their relax time. Having no specific place for market place and the use of loudspeaker very loudly in the morning are the major noises in the morning. People living in high density are suffering from noise pollution all day long, mainly because of the noises from people, since their house are so close to one another.

Table (4.13) Noisiest Time of the Day

Time of the day	Number of respondent	Percentage (%)
Morning	22	15
Afternoons	28	19
Evening	40	27
Night	49	33
All day	11	7
Total	150	100

Source: Survey Data, 2019.

Table (4.14) has shown the noisy months of the year. From this table, the respondents who choose the month April is the highest with 68 respondents (45%). This is because the noise in this month is more diverse compare to others months. The major source of noise in this month is from Myanmar New Year festival, since the noise during this festival is the major reason of having diverse noise. Noise from groups of drunken people shouting and quarrelling, from cars and from small stages and large stage of loudspeakers which open various songs are high comparing to other months.

According to the survey result, 61 respondents out of 150 respondents answered that all twelve months are noisy for them and the main source of noise is from transportation, such as car and train. However, the majority is from car. The reason of this can be as stated above in table (4.11), such as the increase in the number of automobile owner. Moreover, the other noise sources are due to poor urban planning and animal, stray dog. High population density, congested apartment, do not have specific playground for children and having no control of stray dog are the main reason why these respondents are suffering from noise pollution all moths through year.

The month February is with 42 respondents (28%). Since February is the beginning of summer holidays for children, the noise from groups of children playing on the road becomes the major source of noise for this month. This is due to the high population density and having no specific place for children to play. One more reason is because of the Chinese New Year and Thaipusam festival, which are held in this month. Thaipusam festival is celebrates either in January or February. Since

thecelebration date is decided by the Tamil calendar, it can be vary. The sound from these festivals sometimes bothers some respondents.

The noise during the month November is also high with 36 respondents (24%). The major reason is because of the excessive use of loudspeaker during Kahtein festival. During Kahtein festival, people collect donation while playing songs which are not related to religious theme on loudspeaker extremely loudly and it pretty much bother other people. Least noisy month of the year is June with 1 respondent (1%). Since school begins in this month, the noise of children playing is reducing obviously and having no festivals during this month make the month June least noisy among all months.

From the table it can be seen that most respondents chose months with festivals as noisy months of the year although all months are noisy due to other sources of noise mainly from car, train and people. Even though the festivals are not held all days in those months, many respondents consider those months as the noisy months of the year because of the widely used of loudspeakers at excessive level during festivals in addition to the other sources of noise.

Table (4.14) Noisy Months of the Year

Month	Number of respondent	Percentage (%)
January	19	13
February	42	28
March	28	19
April	68	45
May	28	19
June	1	1
July	25	17
August	25	17
September	27	18
October	29	19
November	36	24
December	23	15
All Months	61	41

Source: Survey Data, 2019.

4.3.3 Health Effects

According to WHO, there are many physical and psychological effects caused by noise pollution. Since noise pollution is a silence killer and it takes time to notice its effect on human health, people tend to neglect it. Many people think that noise cannot have serious effects on human health, since it does not show serious health effects immediately.

According to this survey respondents' psychological health are more affected than the physical health, since 59% of the respondents answered that their physical health are affected while 61% of the respondents answered their psychological health are affected. The following show the effect of noise pollution on respondents' health both physically and psychologically.

Table (4.15) Types of Physical Health Effects due to Noise Pollution

Types of physical health	Number of respondent	Percentage (%)
Headache, Dizzy	33	22
Hearing impairment	9	6
Sleepless	70	47
Cardiovascular diseases	17	11
Hypertension	3	2
None	62	41
Other	0	0

Source: Survey Data, 2019.

According to the Table (4.15), respondents (22%) out of 150 respondents are affected from headache and dizzy, 9 respondents (6%) out of 150 respondents are affected from hearing impairment, 70 respondents (47%) out of 150 respondents are affected from sleepless, 17 respondents (11%) out of 150 respondents are affected from cardiovascular diseases, 3 respondents (2%) are affected from hypertension and 62 respondents (41%) have no physical effects due to noise pollution. There are no other physical effects aside from above effects.

From this it can be seen that sleepless is the major physical health effect due to noise pollution. In the long term, it can become a serious problem for human health. The respondents who have no physical effects due to noise pollution are the second highest because they get used to what other respondents consider as noise pollution.

Table (4.16) Types of Psychological Health Effects due to Noise Pollution

Types of psychological health	Number of respondent	Percentage (%)
Lack of concentration	28	19
Decreasing job performance	14	9
Irritability	55	37
Stressed, Depressed	47	31
None	59	39
Other	0	0

Source: Survey Data, 2019.

Table (4.16) shows the respondents' psychological health effects caused by the noise pollution. As in table and figure, noise pollution caused lack of concentration for 28 respondents (19%) out of 150 respondents, decreasing job performance for 14 respondents (9%) out of 150 respondents, irritability for 55 respondents (37%) out of 150 respondents, stressed and depressed for 47 respondents (31%) out of 150 respondents and none for 59 respondents (39%) out of 150 respondents. There are no other psychological effects aside from above effects. From this it can be seen that, since noise is an unwanted sound; people easily get irritated because of noise pollution. The respondents who have no psychological health effects due to noise pollution are the second highest because of the adaptability of the noises in that environment.

Table (4.17) Respondents Perception on the Effect of Noise Pollution on Human Health

How much do you think the noise pollution can affect the human's physical and psychological health?	Number of respondent	Percentage (%)
Violently (Chronic)	1	1
Violently (Sometimes)	17	11
Moderately	37	25
Not much	95	63
Total	150	100

Source: Survey Data, 2019.

According to Table (4.17) 1 respondent (1%) out of 150 respondents thinks the noise pollution can affect violently on the human’s physical and psychological health chronically. 17 respondents (11%) think the noise pollution can sometimes affect violently on human’s physical and psychological health, 37 respondents (25%) think can affect moderately and 95 respondents (63%) think cannot affect much. More than half of the respondents think that noise pollution do not affect very much on human health. By looking at this, many respondents have no idea that the noise pollution can have a serious effect on human health.

Table (4.18) Other Health Problems affecting Respondents’ Health

The physical and psychological health effects that you are suffering are not due to noise pollution but other health problems.	Number of respondent	Percentage (%)
Yes	23	15
No	82	55
Not suffering from any health problems	45	30
Total	150	100

Source: Survey Data, 2019.

Table (4.18) shows that among 150 respondents, 23 respondents’ (15%) physical and psychological health effects (from table 4.15 and table 4.16) are due to other health problems and 82 respondents (55%) are due to noise pollution. 45 respondents (30%) are not suffering from any health problems, meaning that they are healthy people who are familiar with noise pollution in their neighborhood. From this it can be seen that more than half of the respondents confirm that noise pollution have an effects on their psychological and physical health.

4.3.4 Awareness on Noise Pollution

The awareness of public plays an important role in preventing the negative side-effects on human health caused by noise pollution. Government also plays an important role in controlling the level of noise exposure to noise. There are some rules and regulations with regard to control of noise pollution as stated in chapter – 2. However, the enforcement of some of these rules and regulations are still weak and some public do not even know there are rules and regulation to control noise pollution. The following show the respondents awareness on noise pollution.

Table (4.19) Discuss about Noise Pollution

Have you ever discussed about the noise pollution that you have been suffering with other people?	Number of respondent	Percentage (%)
Yes	37	25
No	113	75
Total	150	100

Source: Survey Data, 2019.

According to the Table (4.19), 37 respondents (25%) have discussed about the noise pollution that they have been suffering with other people while 113 respondents (75%) have not. Since more than half of the respondents have not discussed about noise pollution, it can be stated that many respondents are not aware of the noise pollution; probably because they get used to it.

Respondents answered that they discussed about the noise pollution with their family, friends, neighbors and government organization (YCDC). Among them respondents who discussed with their friends and neighbor is the highest.

Table (4.20) shows that 56 respondents (37%) out of 150 respondents know that there are some rules and regulations to control noise pollution while 94 respondents (63%) do not know. This shows that the rules and regulations for noise pollution control are not well known among public. This can be because of the lack of public awareness on those rules and regulation or government's weak enforcement of those.

With regard to the types of rules and regulations, the 56 respondents answered that, the loudspeaker law, the car horn ban and that they can report to the ward administration if the neighbor makes too much noise. Among them, the most well-known one is the loudspeaker law.

Table (4.20) Knowledge about Noise Pollution Control Rules and Regulations

Do you know that there are some rules and regulations to control noise pollution?	Number of respondent	Percentage (%)
Yes	56	37
No	94	63
Total	150	100

Source: Survey Data, 2019.

CHAPTER V

CONCLUSION

5.1 Findings

This study investigates the major source of noise pollution in respondents' neighborhood, the respondents' perception on the effect of noise pollution on people's health and knowledge about rules and regulations of controlling noise pollution. According to the research result, noise from car, such as car with power exhaust, sport car racing and excessive use of car horn without requirement, is the major source of noise pollution in respondents' neighborhood, although there are rules and regulations relating to control the noise from automobile. This finding clearly indicate that there are lack of enforcement or the penalties for rule breaker are not harsh enough or lack of civic consciousness among drivers or the numbers of automobile mobile owner are increasing rapidly year by year.

More than half of the respondents (53%) responded that they can bear the noise pollution in their neighborhood. This indicates that the adaptability of the respondents in their neighborhood, since 73 respondents out of 150 respondents (53%) live in their neighborhood more than 10 years. With regards to the noisiest time of the day, most of the respondents (33%) choose night time. It is found that people tend to aware of the noise during their leisure time, especially when they come back home after their long tiring day.

Regarding to the noisy months of the year, (46%)of the respondents choose April, which is the highest among all months. The major source of noise during this month is due to the Myanmar New Year Festival. From this finding, it can be assumed that the noise during this month is more diverse compare to other months, such as noise from loudspeakers of small to large stages, from cars and from people quarrelling. Although the festival held for at most five days, such diverse noise during festival make many respondents consider this month as the noisy month.

In health effects, 91 respondents out of 150 respondents (61%) answered that their psychological health are affected by noise pollution and 88 respondents out of 150 respondents (59%) answered that their physical health are affected by noise

pollution. According to this finding, it can be assumed that respondents' psychological health is more affected than their physical health by noise pollution. Regarding to the types of physical and psychological health effect, sleepless is the highest in physical health effect with 70 respondents out of 150 respondents (47%) and irritability is the highest in psychological health effect with 55 respondents out of 150 respondents (37%). More than half of the respondents (63%) think that noise pollution cannot have much effect on people's physical and psychological health. This study indicates that most of the respondents do not know the serious effect of noise pollution on people's health.

Moreover, 82 respondents out of 150 respondents answered that their psychological and physical health effects, as mentioned in above, are due to noise pollution and not due to other health problems. This truly indicate that noise pollution do have effects on people's psychological and physical health.

Among 150 respondents, 113 of the respondents have never discussed about the noise pollution, which they have been suffering, with other people while 25% (37 respondents) have discussed about it mainly with their friends and neighbor. According to this result, it can be assumed that most of the respondents do not have awareness on noise pollution or as they are adapted to the noise pollution, they do not see it as a problem.

Concerning with the noise pollution control rules and regulations, 63% (94 respondents) do not know those rules and regulations exist while 37% (57 respondents) know those rules and regulations exist. The most well-known law and regulation among respondents is about loudspeaker. This finding indicates that most of the respondents do not know about the existing rules and regulations. This can be assumed because of the lack of enforcement or public awareness.

Based on the survey finding, noise from transportation is the major source of noise pollution for the respondents in study area and noise pollution do have an effect on people's health. However, there are less awareness about noise pollution among respondents and lack of enforcement on the existing noise pollution control rules and regulations.

5.2 Recommendations

The government should take a strict enforcement on the existing noise pollution control rules and regulations, should implement some rules and regulations concerning with festivals and should set specific time and noise level for the use of loudspeaker. As the population of the urban increases, the volume of noise pollutant is also increase, especially with lack of health education on the health consequences of noise pollution. The ways of reducing noise level and control of noise emission are still needed to introduce. To reduce environmental noise in the neighborhood, there is a need to pay adequate attention to reduce noise in the residential neighborhoods. This requires enforcement of acceptable noise levels set by the Ministry of Environmental Conservation and Forestry for residential area. Moreover, a strict management for increasing number of stray dog is also required.

Myanmar government can learn to have some more specific restrictions on the use of loudspeakers or public address system and sound producing instruments from India. The government also needs to consider to have the noise pollution source monitoring activities and sets the maximum permitted noise level for different category of vehicle just like Cambodia. Government should adopt principle in noise management, carried out stages in noise management and should follow the recommended noise management measures which are suitable for Myanmar situation.

To establish a more specific noise control policies, basic knowledge and awareness of the government on the noise pollution is required. The government should increase the public education about noise pollution as well. Therefore, it is necessary to include noise and its adverse effects on health in school curricula and information about noise pollution and its adverse effects should be spread widely through social media and seminar. More research about the noise pollution in Myanmar and its effects on people health need to be carried out. Extensive plantation of trees or vegetation is required in sensitive areas, such as school and hospital, since they can absorb sound and can therefore reduce noise level.

Normally action to reduce environmental noise has had a lower priority than other pollution, such as air and water pollution. Therefore, in order to control the invisible pollutant of environment, government, public and NGOs need to play a significant role in the process.

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APPENDIX

Survey Questionnaire for Public Perception on the Effects of Environmental Noise Pollution on People's Health (A Case Study in Kamayut Township, Yangon)

1. Age Male Female
2. **Marital status of respondent.**
Married Single Divorce Widow
3. **Number of ward**
4. **Education level of respondent.**
Illiteracy Primary School Middle School
High School University Student Graduated
Post Graduated
5. **Occupation of Respondent.**
Own Business Government Staff Private Staff
Government Pensioner Student Dependent

Please select only one answer for the following questions.

6. **How long have you been living in this house?**
Below 1 year 1-2 years 2-5 years years
Above 10 years
7. **Is your neighborhood in high density?**
Yes No Moderate

8. **Are you suffering from any health problems?**

Yes (Types of health problem)

No

9. **Dose the neighborhood you are living now has noise?**

Yes, it always has. Sometimes has. No, it's quiet.

10. **The following are the sources of noise in your neighborhood.**

Sources of noise	Yes	No
Car		
Train		
Construction site		
Boat or Ship		
Market		
None		
Other		
Name the other sources of noise.		

11. **Is the noise in your neighborhood bearable for you?**

Yes, it is. No, it is not. Sometimes

12. **Which time of the day is the noisiest?**

Morning Afternoons Evening Night

All day

13. The following months are the noisy months of the year.

Month	Yes	No	Reason
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			
All Months			

14. Noise pollution causes the following physical health effects on you.

Types of physical health	Yes	No
Headache, Dizzy		
Hearing impairment		
Sleepless		
Cardiovascular diseases		
Hypertension		
None		
Other		

15. **Noise pollution causes the following psychological health effects on you.**

Types of psychological health	Yes	No
Lack of concentration		
Decreasing job performance		
Irritability		
Stressed, Depressed		
None		
Other		

16. **How much do you think the noise pollution can affect the human's physical and psychological health?**

Violently (Chronic) Violently (Sometimes) Moderately
 Not much

17. **The physical and psychological health effects that you are suffering are not due to noise pollution but other health problems.**

Yes No Not suffering from any health problems

18. **Have you ever discussed about the noise pollution that you have been suffering with other people?**

Yes (With whom.....) No

19. **Do you know that there are some rules and regulations to control noise pollution?**

Yes (Types of rule and regulation.....) No

Thank you very much for your participation.