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Doctoral Thesis

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Doctor of Philosophy in the field of
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ENVIRONMENTAL NOISE ASSESSMENT: METHODS AND ANALYSIS

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Abstract

As a part of everyday life, noise can influence human health, the quality of living and peace of mind. The WHO (World Health Organization) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". This organization also revealed that noise is currently the second largest environmental cause of health problems; just after the impact of air quality. Even if the noise exposure was reduced, it would never be eliminated. Thus, the extent of the environmental noise represents a huge issue, and is consequently in the focus of intense scientific efforts, to date. The main objective of the current Ph.D. thesis is the investigation of environmental noise disturbance. The focus is to identify the most annoying environmental noise sources and their impacts on the perception of the quality of life. To be more precise, the noise impact on the perception of the quality of life in two EU countries will be compared. In order to obtain human response concerning environmental noise, mainly four approaches are used- cross-sectional study, laboratory experiments, data capture and epidemiological studies.

This thesis is divided into three parts. The theoretical part describes the variety of different indicators used to measure and demonstrate environmental noise and the quality of the work environment. Based on a literature study, necessary background information to the topic are presented. This part briefly introduces different noise impacts on human health and behavior, as well. The theoretical part completes with the analysis of European, Czech and German legislation related to environmental noise.

The practical part presents the methodology and results of two surveys carried out in the Czech Republic and Germany. Both surveys deal with environmental noise impacts on the quality of life of people living in environmental noise affected-areas.

The main part of the present work provides a methodology for municipalities, which can be used to quickly and easily determine the satisfaction of the inhabitants with the quality of life and the noise burden in the given municipality. Next, to that, the theoretical and practical benefits of this thesis, evaluation of the results and hypotheses verification are addressed more in-depth. Finally, the main findings are concisely summarized.

Keywords

Environmental noise, environmental noise descriptors, noise impacts on human health and behavior, the quality of life influencing factors, noise limits, noise legislation, methodology.

202 Pages 53 Tables 69 Pictures 4 Appendix

Anotace

Hluk je součástí každodenního života. Ovlivňuje lidské zdraví, kvalitu života a duševní pohodu. WHO (Světová zdravotnická organizace) definuje zdraví jako "stav úplné fyzické, psychické a sociální pohody, a nikoliv pouze život bez přítomnosti chorob nebo nemocí". Tato organizace zjistila, že se hluk stal v současnosti druhou největší příčinou zdravotních problémů, hned po vlivu kvality ovzduší na lidské zdraví. Hluk se může v životním prostředí cíleně snižovat, ale nikdy nemůže být zcela eliminován. Proto je environmentální hluk v dnešní době předmětem pozornosti intenzivního vědeckého zkoumání.

Hlavním cílem této disertační práce je zkoumat různé způsoby hodnocení úrovně hluku životního prostředí. Důraz je kladen na identifikaci nejnepříznivějších zdrojů hluku v životním prostředí a jejich dopadů na vnímání kvality života. Vliv hluku na vnímání kvality života je současně porovnáván ve dvou zemích EU. K získání reakce člověka na environmentální hluk jsou použity převážně čtyři přístupy - případové studie, laboratorní experimenty, sběr dat a epidemiologické studie.

Tato disertační práce je rozdělena do tří částí. Teoretická část popisuje různé ukazatele používané k měření a prokázání environmentálního hluku a kvality pracovního prostředí. Na základě prostudované literatury jsou prezentovány nezbytné podklady k tématu. Stručně uvádí různé hlukové dopady na lidské zdraví a chování. Je zároveň doplněna o analýzu evropských, českých a německých právních předpisů souvisejících s environmentálním hlukem.

V praktické části je popsána metodika a výsledky dvou průzkumů provedených v České Republice a Německu. Oba průzkumy se zabývají dopady hluku na kvalitu života lidí žijících v oblastech postižených hlukem v životním prostředí.

Hlavní část práce poskytuje metodiku pro obce, kterou lze využít k rychlému a snadnému zjištění spokojenosti obyvatel s kvalitou života a hlukovou zátěží v dané obci.

Teoretické a praktické přínosy této práce, hodnocení výsledků a ověření hypotéz jsou podrobněji řešeny a shrnuty v závěrečné části.

Klíčová slova

Hluk ve venkovním prostředí, deskriptory hluku v životním prostředí, vliv hluku na lidské zdraví a chování, faktor ovlivňující kvalitu života, hlukové limity, metodika.

202 Stran | 53 Tabulek | 69 Obrázků | 4 Přílohy

Resümee

Als Teil des alltäglichen Lebens kann Lärm die menschliche Gesundheit, die Lebensqualität und den Seelenfrieden belasten. Die WHO (Weltgesundheitsorganisation) definiert die Gesundheit als "einen Zustand des vollständigen körperlichen, geistigen und sozialen Wohlbefindens und nicht nur das Fehlen von Krankheit oder Gebrechen".

Diese Organisation wies auch nach, dass Lärm derzeit die zweitgrößte Umweltursache für Gesundheitsprobleme darstellt; gleich nach dem Einfluss der Luftqualität. Auch wenn die Lärmexposition reduziert wurde, würde sie niemals eliminiert. So ist das Ausmaß des Umgebungslärms bis heute ein großes Thema und steht damit im Fokus intensiver wissenschaftlicher Bemühungen. Das Hauptziel der aktuellen Dissertation ist die Untersuchung von Umgebungslärmstörungen. Im Fokus stehen dabei die Identifizierung der am meisten störenden Umgebungslärmquellen und deren Auswirkungen auf die Lebensqualität. Um genauer zu sein, werden im Rahmen dieser Arbeit die Lärmwirkungen auf die Wahrnehmung der Lebensqualität von zwei EU-Ländern verglichen. Um eine menschliche Reaktion auf Umgebungslärm zu erhalten, werden vor allem vier Ansätze verwendet – Querschnittsstudien, Laborexperimente, Datenerfassung und epidemiologische Studien.

Die vorliegende Arbeit ist in drei Teile gegliedert. Der theoretische Teil beschreibt die Vielfalt der verschiedenen Indikatoren, die zur Messung und Demonstration von Umgebungslärm und der Qualität der Arbeitsumgebung verwendet werden. Auf der Grundlage einer Literaturstudie werden notwendige Hintergrundinformationen zum Thema prägnant vorgestellt. Dieser Teil führt kurz und knapp unterschiedliche Lärmwirkungen auf die menschliche Gesundheit und das Verhalten ein. Der theoretische Teil vervollständigt die Analyse der europäischen, tschechischen und deutschen Gesetzgebung im Zusammenhang mit Umgebungslärm.

Der praktische Teil präsentiert die Methodik, und Ergebnisse von zwei Erhebungen in Tschechien und Deutschland. Beide Erhebungen befassen sich mit Umweltlärm Auswirkungen auf die Lebensqualität der Menschen in Umgebungslärm betroffenen Gebieten.

Der Hauptteil der vorliegenden Arbeit beschreibt eine Methodik für Kommunen, mit deren Hilfe die Zufriedenheit der Bewohner mit der Lebensqualität und der Lärmbelastung in der jeweiligen Gemeinde schnell und einfach ermittelt werden kann. Des Weiteren werden die gewonnenen Erkenntnisse im Rahmen gängiger theoretischer Vorbetrachtungen diskutiert. Ein Hauptaugenmerk liegt auf der Auswertung der Ergebnisse und der Hypothesenverifizierung, die folglich eingehender behandelt werden. Zum Schluss werden die wichtigsten Erkenntnisse prägnant zusammengefasst.

Schlüsselwörter

Umweltlärm, Umgebungslärmdeskriptoren, Lärmauswirkungen auf die menschliche Gesundheit und das Verhalten, die Lebensqualität beeinflussen Faktoren, Lärmgrenzwerte, Lärmgesetzgebung, Methodik.

202 Seiten	53 Tabellen	69 Bilden	4 Anlagen

Declaration

I hereby submit for the examining and defending the dissertation thesis elaborated at the conclusion of doctoral studies at the Faculty of Electrical Engineering at the University of West Bohemia in Pilsen.

I declare that I have worked on this dissertation independently, using the professional literature and sources listed in this work. I further declare that all the software used to resolve this work is legal.

Prohlášení

Předkládám tímto k posouzení a obhajobě disertační práci zpracovanou na závěr doktorského studia na Fakultě elektrotechnické Západočeské univerzity v Plzni.

Prohlašuji, že jsem tuto disertační práci vypracovala samostatně, s použitím odborné literatury a pramenů uvedených v seznamu, který je součástí této práce. Dále prohlašuji, že veškerý software, použitý při rešení této práce, je legální.

In Pilsen, 30.6.2017

Ing. Zuzana Kabešová

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Finally, I thank the reader for reading my thesis.

Contents

Notations

Abbreviations

AIP_CR	Aeronautical Information Publication Czech Republic
ARIC	Research and Information Centre
ANOVA	Analysis of Variance
ATAG	Air Transport Action Group
CAA	Civil Aviation Authority
CAEP	Committee on Aviation Environmental Protection
CATE	Centre for Aviation Transport and the Environment
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardisation
DIN	German Institute for Standardization (Deutsches Institut für Normung e. V.)
DIN	German Industry Standard (Deutsche Industrie-Norm)
EN	European Standard
IATA	The International Air Transport Association
IPPC	Integrated Pollution Prevention and Control
ICAO	International Civil Aviation Organization
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
LANUV	German State Agency for Nature, Environment and Consumer Protection

MTOW	Maximum Takeoff Weight
NNC	Non-noise certified aeroplanes
NPZ	Noise Protection Zone of Prague airport
NALS	German Standards Committee for Acoustics, Noise Reduction, and Vibration of DIN and VDI
RWY	Runway
UK	United Kingdom
UN	United Nations
VDI	The Association of German Engineers
WHO	World Health Organization
ČSN	Czech National Standard

Magnitudes

A	A-weighted
%A	Percent of (at least) Annoyed People
f	(Hz) Frequency
F_{crit}	Critical value of the F distribution
H_0	Null Hypothesis
H_A	Alternative Hypothesis
kph	Kilometres per hour (km/h)
MS	Mean Squares
L_A	(dB) A-weighted sound level
L_{Amax}	(dB) The maximum A-weighted sound pressure level
L_{den}	(dB) Equivalent sound level of aircraft noise for the 24-hour annual day, evening, and night

L_{day}	(dB) Equivalent sound level of a. noise for the 12-hour annual day (7-19)
L_{dn}	(dB) The Day-Night Level (DNL)
L_{eq}	(dB) Equivalent sound level
$L_{evening}$	(dBA) Equivalent sound level of aircraft noise for 4-hour annual evening (19-23)
L_{night}	(dB) Equivalent sound level of aircraft noise for the 8-hour annual night (23-7)
L_{10}	(dB) A-weighted sound levels exceeded 10 % of the time
L_{50}	(dB) A-weighted sound levels exceeded 50 % of the time
L_{90}	(dB) A-weighted sound levels exceeded 90 % of the time
p	(Pa) Sound pressure
PNL	(dB) Perceived Noise Level
P-value	Probability of Obtaining a Test Statistic
ρ	Spearman's Correlation Coefficient
SEL	(dB) Sound Exposure Level (LAE, LE)
SPL	(dB) Sound Pressure Level
SS	Sum of Squares
%HA	Percent of Highly Annoyed People

1. Introduction

There are many inequalities in human perception of noise in different areas with different noise types. Some noise type could be for some people more annoying than the other one, which is the most annoying for someone else. It is not easy to quantify these inequalities. The human perception of environmental noise will be investigated in the current thesis.

Noise pollution is caused by various sources and concerns not only the urban areas but also the outside urban areas. The environmental noise is considered to be emitted by all sources except for noise in the industrial workplace. The most common and most known noise source is road traffic. This noise is caused by the combination of rolling noise and propulsion noise. Environmental noise is also emitted by other means of transport, mainly by air and rail traffic.[**?**]

According to the WHO, about 40% of the population of the European Union countries is exposed to road traffic noise with an equivalent sound pressure level exceeding 55 dB(A) in daytime, 20% are exposed to levels exceeding 65 dB(A) in daytime and even more than 30 % of people are exposed at night to 55 dB(A). The evidence of the health damage of night-time noise exposure and the concerning recommended threshold values were presented in the WHO's Night Noise Guidelines for Europe. The exposure to 55 dB (A) causes the sleeping disturbance. By long-term exposure above this level, it can also trigger elevated blood pressure and lead to ischaemic heart disease. It is estimated that about half of the EU citizens are currently living in areas which do not ensure acoustical comfort to residents. [1]

In 2011, at the Faculty of electrical engineering of University of West Bohemia, there was written and defended one doctoral thesis, which dealt with the analysis of wind turbine noise with the main focus on human perception to noise generated by wind turbines.[2] Local authorities still underestimate wind turbines as a serious noise source. As a consequence, the perception of wind turbine noise will be also addressed as a noise source in the course of the present thesis.

Nowadays, people's tolerance to noise exposure seems to undergo a change. Levels of disturbance, which were acceptable in the past, will not be accepted in the future. Environmental noise in relation to the quality of life and residential satisfaction is a relatively less explored area. The connection between human perception of different types of environmental noise, socio-economic factors of annoyance caused by environmental noise and noise measuring need to be explored more in depth.

Part I.

Theoretical Part

2. Fundamentals

In European "Directive 2002/49/EC", environmental noise is defined as unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity. [3] Environmental noise is also described as a pollution in "Council Directive 96/61/EC concerning integrated pollution prevention and control" together with other results of human activity, of substances, vibrations, heat into the air, water or land which may be harmful to human health or the quality of the environment. [4]

The environmental noise affects a large number of people, especially in urban areas. Exposure to traffic noise is associated with a wide range of noise impacts on human health and well-being. According to the WHO, excessive noise can seriously harm human health and disturb people's daily activities at home, at school, at work and during leisure time. [1]

2.1. Road Traffic Noise

Causes of the road traffic noise can be divided into two types - noise caused by traffic flow, more precisely caused by a continuous stream of vehicles, and noise caused by individual vehicles. [5]

Traffic Flow

The traffic flow noise is determined by its sound power per unit length, which corresponds to the sum of the sound emission of the individual vehicles in the traffic stream, considering the time spent by the vehicles in the considered road section. This type of noise appears on busier roads like for instance highways.[5]

Individual Vehicles

This type of noise can appear anywhere and anytime because it is caused by single vehicles. The special cases which may occur are for instance a car with a modified exhaust system or a loud motorbike.

The contributions to total vehicle noise are the engine, the transmission and silencers, the exhaust, the interaction of tires and road surface, air turbulence, and body and load rattles.[5][6]

Engine and exhaust noise seems to be prevailing at lower speeds less than 60 kph. The tire-road surface interaction noise rises when the car's speed rises. According to the studies, tire noise tends to outshine the other noise sources at speeds from 30 to 50 kph. [5]

There are other important factors which have an impact on the change of noise level produced by road traffic: traffic volume, traffic speed, traffic composition, the road gradient, and the road surface type and texture.[5]

Besides noise sources and causes, the noise propagation is very important. Further factors can affect the propagation of traffic noise: the road profile, the distance from the source to the point of perception. the nature of the ground between the source and the point of perception, the angle of view of the traffic stream from the point of perception, the presence of screening (fences, barriers, buildings etc.), and of course meteorological effects, especially wind strength and direction. [5]

The most important factors, which affect noise propagation, are [7]:

- Type of source (point or line)
- Distance from source
- Atmospheric absorption
- Wind
- Temperature and temperature gradient
- Obstacles such as barriers and buildings
- Ground absorption
- Reflections
- Humidity

2.2. Aircraft Noise

The noise caused by an aircraft flight is a quite complex issue. Many of the sources of aircraft noise generate the same noise by all of the aircraft types, only in different magnitude. There are two basic noise types: the noise of the aircraft itself and aerodynamic noise. [8]

Propulsion Noise

Propulsion noise consider various of noise sources caused by a fan (propeller), compressor, turbine, combustor, and jet exhaust. [9]

- **Jet noise** is caused by mixing of the high-velocity exhaust stream of hot gases with the surrounding environment.
- **Combustor noise** is connected with the rapid oxidation of the jet fuel and the associated release of energy.
- **Turbomachinery noise** is associated with taking off and approach towards people.

Aerodynamic Noise

This type of noise is originating from rapid air movement over lifting and control surfaces, such as flaps and slats, and around landing gears. Aerodynamic noise increases with aircraft speed and also at low altitudes due to the density of the air.[9]

New technologies in modern aircraft have achieved significant reductions in jet noise, combustor noise, and turbomachinery noise. Aerodynamic noise remains the main source and the current area of acoustic research to reduce aircraft noise. [9]

2.3. Wind Turbine Noise

A wind turbine can generate four types of noise when running: **broadband, tonal, low-frequency** and **impulsive**. An operating wind turbine produces noise which can be divided into two groups – mechanical noise and aerodynamic noise. [10]

Mechanical Noise

Mechanical noise is generated by the relative motion of mechanical and electrical components and the dynamic response among them. The sources of mechanical noise are gearbox, generator, yaw drives, cooling fans, hydraulics or other auxiliary equipment. This noise has naturally tone character and can be spread through the air (air-borne) and structures (structure-borne). The mechanical noise of modern wind turbines is not the dominant source, since its reduction by gear design, flexible seating, dampening gondola and oil-cooling of the generator in the 1980s. [10][11]

Aerodynamic Noise

Aerodynamic noise originates from the interaction of the flow of air and wind turbine blades. This sound is described as a dominant part of noise generated by a wind turbine. Aerodynamic noise raises the volume with rotor speed. There is a large number of complex flow phenomena appearing, each of which can produce some sound, as described in **Fig.** 2.1. [10]

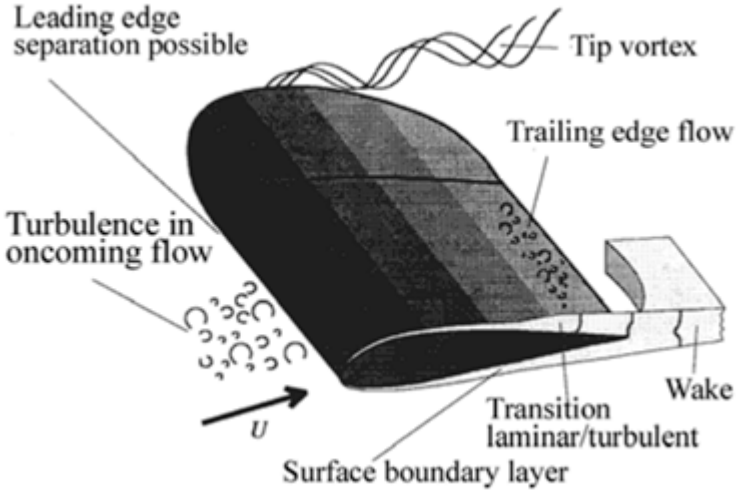

Figure 2.1.: Schematic of Flow around a Rotor Blade *(Source: Wind Turbine Noise* [12])

The aerodynamic sound generation mechanisms [10][12]:

- **Low-frequency noise** appears when the rotating turbine blade encounters localized flow deficiencies due to the flow around a tower, wind speed changes, or wakes shed from other blades.
- **Inflow turbulence noise** is the result of velocity fluctuations between air layers due to the ground surface or temperature gradient. It is manifested by air eddy in the air flow passing through the rotor.
- **Airfoil self-noise** is caused by the air flow right along the surface of the airfoil. It is mostly of a broadband nature, but tonal components can be generated due to blunt trailing edges, or flow over slits and holes. Airfoil noise has several sources [11]:
  - Turbulent boundary layer trailing edge noise
  - Separation stall noise

- Laminar boundary layer vortex shedding noise
- Tip vortex formation noise
- Trailing edge bluntness vortex shedding noise

2.4. Railway Noise

The main sources of noise from rail transport are aerodynamic, the propulsion system (noise of the collector, noise of a drive machine) and rolling noise. The importance of these components varies with the speed of the rail vehicles; with moderate simplification, traction noise (ie noise from propulsion units) prevails at speeds of up to 60 kph, the rolling high-velocity is dominated in the velocity from 60 to 160 kph. At speeds above 160 kph, aerodynamic noise is the most significant. The relation of the three noise sources is depicted in the **Fig. 2.2.**

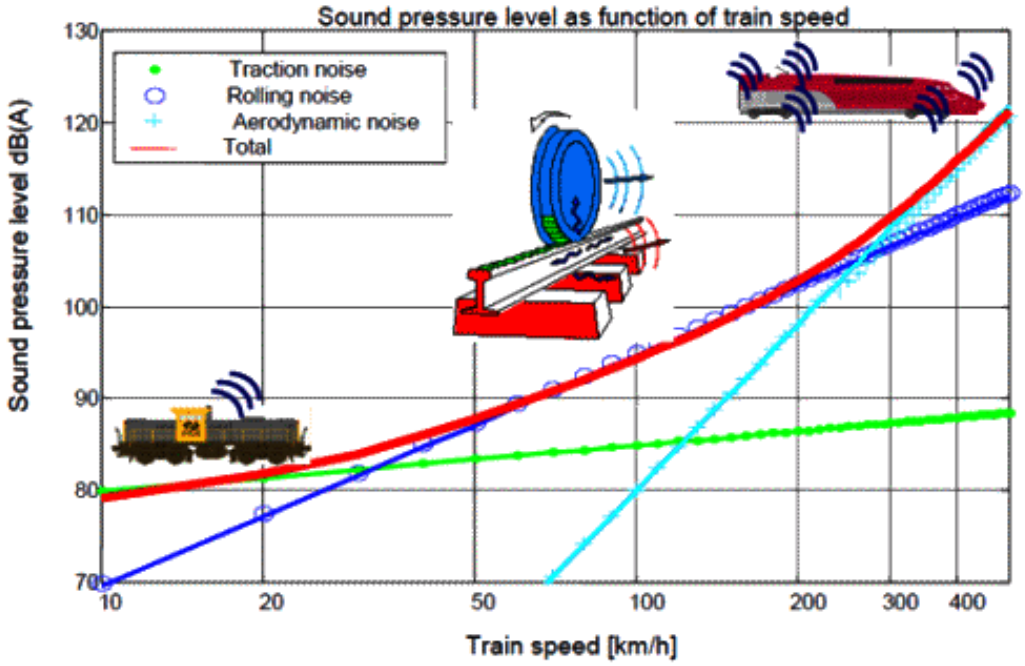

Figure 2.2.: Sound Pressure Level as a Function of Train Speed *(Source: Development of Action Plans for Railways)*

The other sub-components of the noise load are, for example, braking noise, acoustic announcements by radio, sound signals related to the operation of rail transport, etc. The significance of the components constituting the total noise emission depends on a number of factors, including route guidance and traffic intensity. The speed and type of traction play a major role, often

neglected by noise, the source of which is the rotating parts of the chassis of railway vehicles. An insignificant but often overestimated is the proportion of noise emissions resulting from the construction and technical condition of the railway superstructure. [13]

Due to the line speeds on the railway network in the Czech Republic, the rolling noise level is of utmost importance, which should also be addressed in the effort to reduce the noise pollution of the population in the vicinity of railway lines. Rolling noise is caused primarily by the contact of the wheel surface with the rail, and it also occurs at all points in the chassis, where friction occurs due to the rotation of the wheelsets. [13]

2.5. Environmental Noise Descriptors

Precipitation ISO 1996-1: 2003 (Acoustics – Description, measurement, and assessment of environmental noise – Part 1: Basic quantities and assessment procedures) recommends using noise descriptors for the environmental noise assessment. The most common used descriptors are Leq, Ldn, Ln, SEL, and maximum instantaneous SPLs. All of them are expressed in dB(A) units. [14]

- $L_{Aeq,T}$ or the **Equivalent Continuous Sound Pressure Level** is the constant noise level, that has the same total energy as the original fluctuating noise produced over the given period of time T. More precisely, it is defined as the single SPL that, if constant over the stated measurement period, would contain the same sound energy as the actual monitored sound that is fluctuating in lever during the measurement time. This noise descriptor is commonly used to the assessment of traffic noise sources. [15] [14]

- $L_{AN,T}$ or the **Percentile Level**, is exceeded for $N\%$ of a stated time period T, N can be any number between 0 and 100, and corresponds to the percentage of the measurement time period by which the sound level has been exceeded.The most commonly used are L_{90}, L_{50}, L_{10}, L_{1}. Percentile levels reveal maximum and minimum noise levels. They are used in baseline studies and in environmental impact statements to protect against new runways, new highways and new industrial plants degrading the acoustic quality of the environment. [15][7][14]

- $L_{A,dn}$ or the **Day-Night Equivalent Sound Level (DNL)** is a long-term descriptor, defined as 24 hours continuous L_{Aeq} with 10 dB added to all signals recorded between 10 p.m. and 7 a.m. The 10 dB addition is due to accounting for the extra sensitivity of people during sleeping. This noise descriptor is commonly used for noise mapping around Airports. [14] More recently introduced indicators, such as ***N70*** and ***PEO/AEI*** are

useful in communicating the impact of aircraft noise but are subject to limitations and do not replace L_{Aeq} type indicators that remain the basis of aircraft noise impact assessment internationally. [16]

- **Sound Exposure Level (SEL) -** L_{AE} is a constant level in dB(A). SEL lasting for one second has the same amount of acoustic energy as a given A-weighted noise event. The most commonly encountered transient noise levels come from vehicle pass-bys and aircraft flyovers.[15][7]
- **EPNL** or the **Effective Perceived Noise Level** expressed in EPNdBd determines damage risk criteria. [14]
- The **Sound Pressure Level (SPL)** is a logarithmic measure of the effective pressure of a sound relative to a reference value. [15]

Single event

Majority of the environmental noises can be described by several simple measures. All measures consider the frequency content of the sounds, the overall sound pressure levels and the variation of these levels in time. It is important to know if the noise is continuous, intermittent or impulsive, noise could also have tones or be low-frequency noise, which differs too. [17]

2.6. Noise Impacts

Noise can affect human health directly or indirectly. The most evident impact of noise is to our hearing system caused by high sound pressure level or long-lasting noise exposition. Noise can disturb sleep, cause cardiovascular and psychophysiological e effects and it can reduce productivity and the ability to learn. It provokes annoyance responses and changes in social behavior. [1]

Everyone is affected by noise differently. What one enjoys could not be bearable for another one – e.g. music. So the effect of annoyance differs but the health risk of hearing loss probably stays on the same level. Factors that affect individual annoyance to noise can be divided into three groups. The primary acoustic factors are sound level, frequency, and duration. There are also secondary acoustic factors which include spectral complexity, fluctuations in sound level, fluctuations in frequency, rise/time of the noise, localization of noise source and physiology. The third group consists of people's adaptation and past experience, how the listener's activity affects annoyance, the predictability of when a noise will occur, it is noise necessary, individual differences and personality. [18]

Noise disturbance is described as any sound perceived as irritating or a nuisance. When people are annoyed by the noise they usually try to reduce the noise loudness, avoid it or leave the noisy area. Response to aircraft noise differs from person to person and depends on different socioeconomic factors, quality of life, relationship with the airport and perceived benefits. The community responses can be easily divided into two groups – action or tolerance. There are complaints addressed to the airport and other institutions or people have more benefits from the airport so they do not complain or sometimes they do not need to complain or even have fear of complaining. [19]

2.6.1. Health Effects

Noise influences our lives a lot. Widespread exposure to environmental noise contributes to the burden of disease. Noise disturbs our speech communication, our rest activities such as reading, watching TV, sitting outside our houses etc. and our sleep. It has several effects on the psycho-physiological side of the human body, mental-health, performance, and ability to learn. It also influences residential behavior and annoyance. [17]

In 1999, WHO summed up the scientific proof on the harmful effects of noise on human health. They found out that noise causes not only noise-induced hearing impairment but also cardiovascular diseases, tinnitus, sleep disturbance, annoyance, cognitive impairment. [1]

Most physiological impacts of noise are hypothesized to be caused by the stress associated with noise exposure. The criteria for noise effects on people have been developed for noise-induced hearing loss, speech interference, sleep interference, and annoyance. [14]

Cardiovascular diseases

There is evidence from epidemiological studies, which have been done in last few years, on the association between exposure to road traffic and aircraft noise and hypertension and ischemic heart disease. It was proved that road traffic noise can increase the risk of ischemic heart disease, including myocardial infarction. Road traffic noise and aircraft noise increase the risk of high blood pressure[1]

Cognitive impairment in children

Research based on available evidence, a hypothetical exposure-response relationship between noise level (Ldn) and risk of cognitive impairment proved that the reduction in cognitive ability in school-age children occurs while the noise exposure persists and will persist for some time after the end of the noise exposure. [1]

Sleep disturbance

Sleep disturbance and annoyance are mostly related to road traffic noise, comprise the main burden of environmental noise. It can be measured electrophysiologically or by self-reporting in epidemiological studies using survey questionnaires. [1]

Hearing impairment

This is normally defined as an increase in the threshold of hearing. Tinnitus may accompany hearing deficits. Noise-induced hearing impairment is the most prevalent irreversible occupational hazard and it is estimated that 120 million people worldwide have disabling hearing difficulties. The problem of hearing impairment is the inability to understand speech in daily living conditions, and this is considered to be a severe social handicap. [17]

Tinnitus

Tinnitus known as ringing in the ears can be defined as a hearing of sound in the absence of an external sound source. It appears very often in cases when someone is exposed to excessive noise. About 50% to 90% of people with chronic noise trauma report tinnitus. In some people, tinnitus can cause sleep disturbance, cognitive effects, anxiety, psychological distress, depression, communication problems, frustration, irritability, tension, inability to work, reduced efficiency and restricted participation in social life. [1]

2.7. Annoyance

WHO defines health as ”a state of complete physical, mental and social well-being and not only the absence of disease or infirmity”. Consequently, the high level of annoyance caused by environmental noise should be considered as one of the environmental health burdens. [1]

There were many studies trying to evaluate numerically the annoyance of noise. The most widely accepted annoyance criteria related to noise from transportation sources such as aircraft, road traffic or trains were developed by Schultz. He also established the relationship between the L_{dn} and the percent of people highly annoyed (% HA). [14]

Also, Miedema and Oudshoorn determined a more clarifying model for predicting three levels of noise annoyance for the road, rail and aircraft noise for two alternative noise metrics: the day-night levels (mostly used in the USA) and the day-evening-night levels confirmed in the EU's Environmental Noise Directive. [20]

ISO/TS 15 666:2003 [21] defines noise-induced annoyance one person's individual adverse reaction to noise with two following notes:

1. The reaction may be referred to in various ways including, for example, dissatisfaction, bothering, annoyance and disturbance due to noise.

2. Community noise annoyance is the prevalence rate of this individual reaction in a community, as measured by the responses to questions specified in Clause 5, and expressed in appropriate statistical terms.

The more detailed definition of the noise annoyance determined by T. H. Pederson in [22] is depicted in the **Fig. 2.3.** Pedersen developed logistic functions for exposure-response annoyance relationships with various covariates representing the impacts and parameters of noise sources, locations, activities, perceived acoustic attributes and non-acoustic factors. [23]

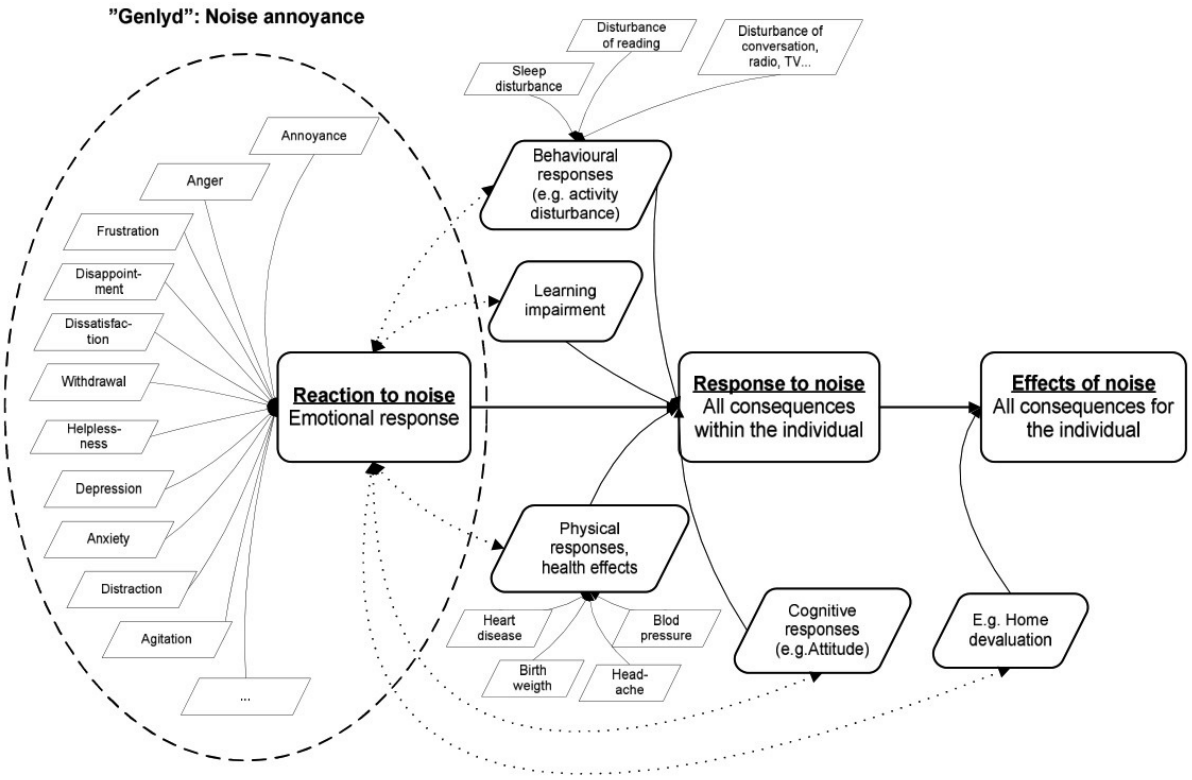

Figure 2.3.: Overview of Effects of Noise and their "Classification". *Source: Genlyd - Concepts and Definitions* [22]

There are two main types of annoyance:

Specific annoyance

- **Accumulated specific annoyance** means the annoyance for a specified stimulus in a specified context for specified persons integrated over time and experiences. Examples of this type of annoyance [23]:
  - Watching a TV influenced by traffic noise
  - Neighbour commonly sings in the bathroom early in the morning
  - Working next to noisy coffee machine
- **Immediate annoyance** means the annoyance for a specified stimulus in a specified context for specified persons when the noise actually is present during or immediately before the evaluation of the particular noise. Examples concerning this type of annoyance [23]:
  - A loud motorbike passing while having a conversation on a phone
  - Meeting a brush cutter on a walk in the park
  - A loud argument between colleagues while you are working in an open space

Global annoyance

- is the accumulated specific annoyance integrated over a range of contexts and over a range of locations at home (e.g. on the balcony, in the kitchen, in the bedroom). [21]

2.7.1. Measurement of Annoyance

The question and answering scale for assessing the self-reported noise annoyance should follow the ISO/TS 15 666: 2003 [21]. The answers can be expressed on semantic and numerical categorical scales and should state the spontaneous subjective feelings about the noise.

The 11-point numerical scale according to ISO/TS 15 666: 2003 is illustrated in the **Fig. 2.4.**

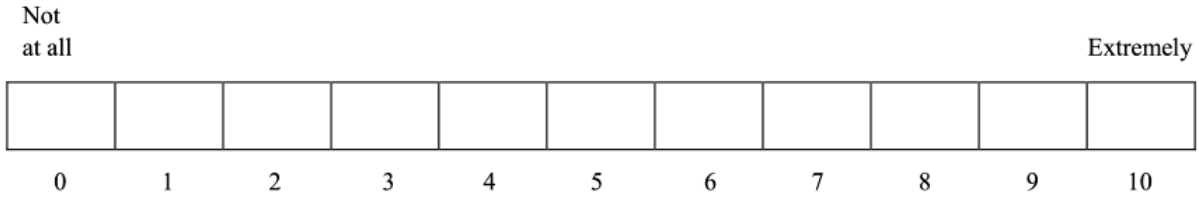

Figure 2.4.: The 11-point categorical scale from 0-10 *Source: ISO/TS 15666* [21]

The verbal scale offers the respondent the following opportunity to express the degree of annoyance [21]:

- "Not at all"
- "Slightly"
- "Moderately"
- "Very"
- "Extremely"

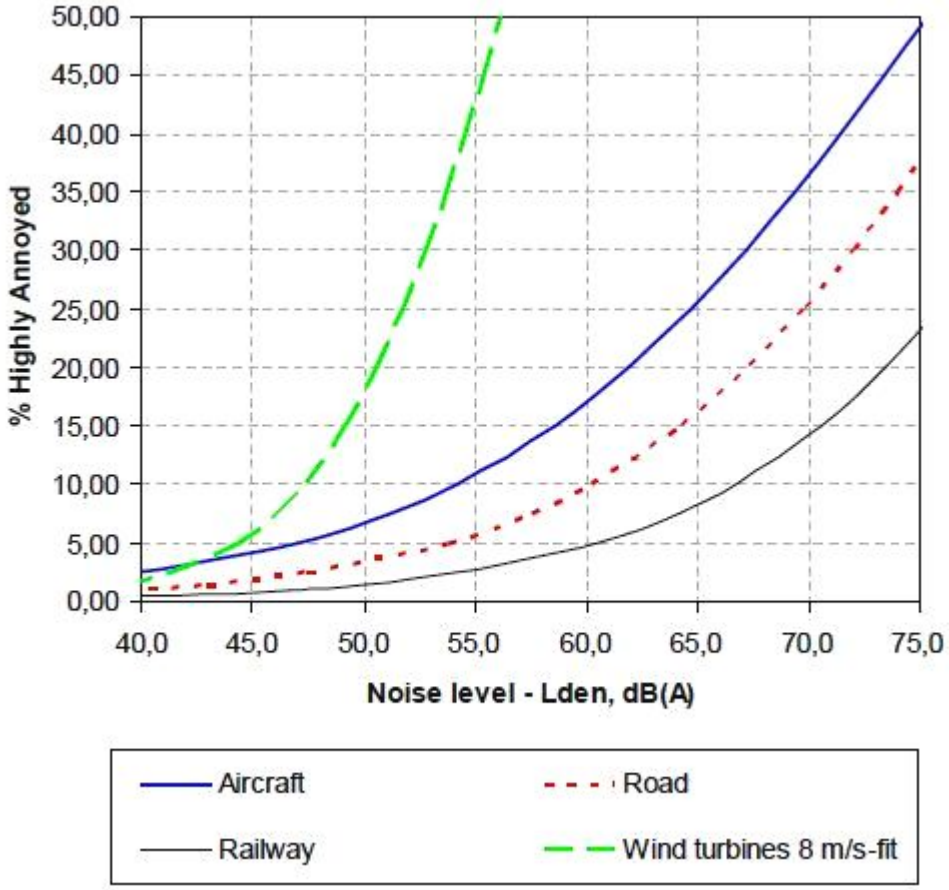

Figure 2.5.: Norm Curves for the Relation between Noise Level (L_{den}) and %HA. *Source: The "Genlyd" Noise Annoyance Model* [24]

The average values are subsequently converted to a 0-100 scale, and the response can be expressed as[23]:

- **The percentage of highly annoyed (%HA)** is in accordance with the percentage of people responding above 72 (the top 27-29%) of the response scale, i.e. the verbal categories "Very" and "Extremely" or the numerical categories 8, 9, and 10.
- **The percentage of (at least) annoyed (%A)** means the percentage of people responding with an answer above 50, i.e. the verbal categories "Moderately", "Very" and "Extremely" and the numerical categories 5 to 10
- **The percentage of (at least) little annoyed (%LA)** represents the percentage of people giving an answer above 28, i.e. the verbal categories "Slightly" and above and the numerical categories 3 to 10.

Furthermore, it is useful to compare the values from the numerical categorical scale to a common reference of sound pressure levels. (Usually comparison to the L_{den} for road traffic noise is used.)

Several surveys and measurements have been carried out to define the norm curves, which gives the relation between the general exposure and the annoyance reaction. The examples for norm curves for aircraft, road traffic, railway, and wind turbines are depicted in the **Fig. 2.5**. This represents an average situation for sound characteristics, context, and personal factors, which is relevant for the actual source. The norm curves are based on L_{den} -values.

2.7.2. Socioeconomic Factors

The environmental noise impacts may be evaluated by assessing its interference with social behavior and other activities. Socioeconomic and demographic inequalities in exposure to environmental hazards exist everywhere. These inequalities can be expressed in relation to factors that may affect the risk of being exposed, such as income, education, employment, age, sex, race/ethnicity and specific locations or settings. In addition to those differences in exposure, environmental health inequalities are also caused by social or demographic differences in vulnerability towards certain risks. [1] [17]

Many factors can affect the noise annoyance additionally to the noise exposure and characteristics of the noise source. The factors associated with a person itself are for instance age, stress level, duration of exposure to noise, noise sensitivity. Other variables related to a house are a number of windows, orientation towards the noise source. The noise sensitivity is presumably the most important non-acoustic factor of annoyance. The demographic factors have commonly not so strong impact.[25][26][27]

2.8. The Role of Aviation

The role of aviation in supporting social and economic development is very important. The airports bring significant social and economic benefits starting from fast and cost-effective transportation of passengers and freight, through contributing the overall economic growth of nations, providing significant revenues to national public finances, improving employment rate by creating large numbers of high-value jobs opportunities to delivering extensive catalytic benefits to international trade and tourism. It can be assumed that the aviation is essential to today's global economy. [28]

It is helpful to differentiate four kinds of economic impacts – direct impacts, indirect impacts, catalytic impacts and induced impacts, in order to obtain some quantitative estimates. **Direct impacts** mean direct employment and activity in the air transport industry itself. **Indirect impacts** include employment and activity of suppliers to the air transport industry such as aviation fuel suppliers, manufacturers of goods sold in airport, wide variety of business services etc. **Induced impacts** mean the spending of those directly or indirectly employed in the air transport sector supports jobs in **catalytic impacts** industries such as retail outlets, companies producing consumer goods and a range of service industries. The aviation industry also has **catalytic impacts** for instance on opening up new markets a favoring international trade, encouraging companies to invest in one country or region driving efficiency gains, enabling people to work abroad and companies to access a wider pool of qualified workers. The air transport is essential to growth and sustainability of tourism. [29] [28]

One of the social benefits of aviation is keeping families and social networks together. It enables also easier traveling for leisure and personal fulfillment. Aviation supports studying abroad. There is an increasing trend to studying abroad. Universities in the United States as well as in Europe attract many foreign students every year. Easy movement into and out of developing regions can also provide opportunities to learn new skills which lead to increasing employment and raising standards of living.[29]

The aviation has not only advantages. At a global level, aviation is estimated at around 2% of worldwide CO_2 emissions and among others produces noise. At a local level, the operation of airports gives rise to many negative environmental impacts that can constrain airport growth the most significant of which is the disturbance caused by aircraft noise. The responsible policy should work toward a sustainable balance between positive impacts and the cost inherent in future growth because while the benefits of aviation are felt across entire regions, the noise impacts are borne by the residents of communities close to the boundary of the airport and along its approach and departure routes. If an airport does not achieve the correct or 'sustainable' balance then community opposition may cause operational constraints or even failure by the airport to gain

planning permission for further infrastructure growth. The disturbance caused by aircraft noise can, therefore, constrain the ability of airports to grow and contribute to social and economic development. [29] [19]

2.9. The Role of Road and Railway Traffic

The role of road and railway traffic is similar to the role of aviation in terms of supporting social and economic development, including transport of persons, raw materials, things or information.

Increasing traffic also increases the burden on the environment, especially the air, as well as underground and surface water and soil. It can be also not overlooked the occupation of the land by the transport infrastructure and the division of the landscape that affects the migration of the animals. The road traffic noise is the most common type of environmental noise that people encounter. It has a considerable effect on human health and well-being. The rail transport is considered to be environmentally friendly transport mean, but it is also a significant producer of noise emissions. The responsible policy should also work toward a sustainable balance between positive effects of the road traffic and its burden on the environment and people.

3. The Legislation Related to Noise

The following chapter offers an overview of the noise-relevant regulations at national (Czech and German), European and international level. The review mainly includes legislation, directives, commission decisions, and standards,

3.1. European Noise Legislation

EU policy considers the limitation of noise from transport vehicles and certain types of equipment as a necessary step towards reducing noise pollution in the European Community. The main focus is on noise abatement through the use of mandatory technical standards for products. There is a set of directives establishing noise emission limits for particular products: motor vehicles (included motorcycles, tires), airplanes, household appliances, and outdoor equipment. Until now, there is no EU directive actively addressed to noise from wind turbines.[30]

Directive 2002/49/EC

The most important directive related to environmental noise is the Environmental Noise Directive - END, which deals with the creation of noise maps and action plans in order to reduce environmental noise. The aims of the Environmental Noise Directive are to provide for a common approach to the avoidance, prevention, and reduction of the harmful effects of exposure to environmental noise, harmonizing noise indicators and assessment methods for environmental noise.

These aims are to be achieved by the progressive implementation of [3]:

- Determination of exposure to environmental noise,
- ensuring that information on environmental noise and its effects are made available to the public,
- preventing and reducing environmental noise where necessary and preserving environmental noise quality where it is good.

3.1.1. Road Traffic Noise

The directives connected with type-approval procedures for motor vehicles and motorcycles, with respect the noise emissions, establish limits on allowed sound levels for the vehicles, their exhaust systems, and silencers. These directives set also requirements for their measurement and testing. [30]

Directive 70/157/EEC

The directive on the approximation of the laws of the Member States relating to the permissible sound level and the exhaust system of motor vehicles sets limits on sound levels of road vehicles and describes procedures for measuring sound levels of exhaust systems and silencers. [31]

Council Directive 97/24/EC

The directive on certain components and characteristics of two- or three-wheeled motor vehicles introduces limits for the permissible sound level of motorcycles, and requirements for exhaust or intake silencers. The directive also outlines harmonized testing procedures. [32]

Directive 2001/43/EC The directive relating to tyres for motor vehicles and their trailers and to their fitting determines limits on the noise generated where the tyre meets the road. These limits are different depending on vehicle type (cars, vans, and trucks) and tyre width (5 classes) and will be enforced by including tyre noise tests in EC type-approval certificate requirements, which must be met for any tyre to be placed on the EU market. [33]

3.1.2. Aircraft Noise

The directives dealing with aircraft noise should limit noise emissions from the aircraft and their operation. They refer to the Convention on International Civil Aviation. These directives deal with subsonic aircraft noise and with the operation of aircraft in the airports of the Member States. [30]

Directive 80/51/EEC The directive on the limitation of noise emission from subsonic aircraft (as amended by Council Directive 83/206/EEC) determines the limits on noise emissions for aircraft registered in the territory of the Member States. **Directive 83/206/EEC** was prepared for expanding the application of Directive 80/51/EEC to cover aircraft from none-Member States flying to EU destinations. [34]

Directive 89/629/EEC The directive on the limitation of noise emission from civil subsonic jet airplanes of 4 December 1989 bans older noisy aircraft from being added to Member State registers. [35]

Directive 92/14/EEC The directive on the limitation of the operation of aircraft covered by Part II, Chapter 2, Volume 1 of Annex 16 to the Convention on International Civil Aviation (as amended by Council Directive 98/20/EC and 1999/28/EC) establishes more stringent rules on the operation of aircraft by submitting all aircraft operating in airports situated in the territory of the EU to international noise standards (Part II, Chapter 2, Volume 1 of Annex 16 to the Convention on International Civil Aviation, second edition). This directive is no longer in force. [36]

Directive 98/20/EEC Amending directive clarifies certain provisions of the directive, including exemptions and applicability to non-EU aircraft. Commission Regulation (EC) No. 991/2000 changes the list of exceptions in the annex to the directive. [37]

Regulation 598/2014/EC This regulation repealed Directive 2002/30/EC, which established the rules and procedures with regard to the introduction of noise-related to operating restrictions at Community airports of 2002, and described procedures for the introduction by Member States of noise-related operating restrictions at EU airports, and allowed stricter provisions for certain city airports. The main objective of the common transport policy mentioned in the new regulation is sustainable development concerning an integrated approach aimed at ensuring both the effective functioning of transport systems and protection of the environment. [38] [39]

Directive 2006/93/EC of the European Parliament and of the Council of 2006 on the regulation of the operation of aircraft covered by Part II, Chapter 3, Volume 1 of Annex 16 to the Convention on International Civil Aviation, second edition (1988) (codified version). [40]

The directives and regulation give effect to Annex 16 to the Convention on International Civil Aviation. The convention, which EU Member States have ratified, comprehensively regulates international civil aviation. [30]

3.1.3. Railways

Majority of the noise-restricting measures stays the responsibility of the candidate countries rather than the private sector because most railway systems are still owned and operated by the state. [30]

Directive 2007/32/EC [41]

The purpose of this directive is to achieve the interoperability of the European high-speed train network at the various stages of its design, construction, gradual placing in service and operation.

Directive 2004/50/EC [42]

This directive amends Council Directive 96/48/EC on the interoperability of the trans-European high-speed rail system and Directive 2001/16/EC of the European Parliament and of the Council on the interoperability of the trans-European conventional rail system. The article 23 of this directive mentions noise problems deriving from rolling stock and infrastructure.

Commission Decision 2004/446/EC presents the basic parameters of the 'Noise', 'Freight Wagons' and 'Telematic applications for freight' Technical Specifications for Interoperability referred to in Directive 2001/16/EC.

3.1.4. International Standards Related to Environmental Noise

The list below includes the most important international standards related to environmental noise and associated with this thesis. The name of a standard is always used to identify the organization and the scope of the standards.

- **ISO 1996-1** Acoustics - Description and measurement of environmental noise — Part 1: Basic quantities and procedures [43]
    - The scope of this document is to define the basic quantities to be used for the description of noise in community environments. This standard describes basic procedures and methods to assess environmental noise. It also provides a guidance on predicting the potential annoyance response of a community to long-term exposure to various environmental noise sources.
- **ISO 1996-2** Acoustics - Description, measurement and assessment of environmental noise — Part 2: Determination of sound pressure levels [44]
    - The aim of this standard is to characterize how sound pressure levels intended as a basis for assessing environmental noise limits or comparison of scenarios in spatial studies can be determined. As described in this document, the determination can be done by direct measurement and by extrapolation of measurement results by means of calculation. The guidance is given for outdoors as well as for indoor measurements. This standard is to be used by all kinds of environmental noise sources, such as road and rail traffic noise, aircraft noise and industrial noise.

- **ISO 1996-3** Acoustics - Description and measurement of environmental noise — Part 3: Application to noise limits [45]
    - This document provides guidelines for the specification of limits of noise and describes methods for the acquisition of data that enable specific noise situations to be checked for compliance with specified limits of noise.
- **ISO/TS 15666:2003** Acoustics - Assessment of noise annoyance by means of social and socio-acoustic surveys [21]
    - The aim of this document is providing specifications for socio-acoustic surveys and social surveys which include questions on noise effects (briefly referred to hereafter as "social surveys"). This technical specification contains questions to be asked, response scales, key aspects of conducting the survey, and reporting the results. Methods for the analysis of data obtained from these questions are not a part of this document.

Noise emitted by different means of transport

- **ISO 362-1:2015** Measurement of noise emitted by accelerating road vehicles – Engineering method – Part 1: M and N categories [46]
- **ISO 362-2:2009** Measurement of noise emitted by accelerating road vehicles – Engineering method – Part 2: L category [47]
- **ISO 362-3:2016** Measurement of noise emitted by accelerating road vehicles – Engineering method – Part 3: Indoor testing M and N categories [48]
- **ISO 5130:2007** Acoustics – Measurements of sound pressure level emitted by stationary road vehicles [49]
- **ISO 9645:1990** Acoustics – Measurement of noise emitted by two-wheeled mopeds in motion – Engineering method [50]
- **ISO 11819-1:1997** Acoustics – Measurement of the influence of road surfaces on traffic noise – Part 1: Statistical Pass-By method [51]
- **ISO 11819-2:2017** Acoustics – Measurement of the influence of road surfaces on traffic noise – Part 2: The close-proximity method [52]
- **ISO/TS 11819-3:2017** Acoustics – Measurement of the influence of road surfaces on traffic noise – Part 3: Reference tyres [53]

- **ISO/PAS 11819-4:2013** Acoustics – Method for measuring the influence of road surfaces on traffic noise – Part 4: SPB method using backing board [53]
- **ISO 10844:2014 Acoustics** – Specification of test tracks for measuring noise emitted by road vehicles and their tyres [54]
- **ISO 3891** Acoustics – Procedure for describing aircraft noise heard on the ground [55]
- **ISO 3095:2013** Acoustics – Railway applications – Measurement of noise emitted by railbound vehicles [56]

A Standard Created by International Electrotechnical Commission Related to Environmental Noise:

IEC 614-11:2012 Wind turbines - Part 11: Acoustic noise measurement techniques - presents measurement procedures that enable noise emissions of a wind turbine to be characterized [57]

3.2. Czech Noise Legislation

3.2.1. Acts

Act No. 258/2000 Coll., on the protection of public health and amendment of some related Acts, as subsequently amended (newest No.267/2015 Coll.). This Act implements the relevant regulations of the European Communities. Section 30 of the Act states that the airport operators shall be obliged to ensure by means of technical, organizational and other measures that the noise does not exceed hygienic limits specified in a regulation for implementation for protected outer premises, protected inner structure premises and protected outer structure premises. Section 31, Paragraph 2 of the Act states that in case hygienic limits for noise from the operation of international public airports ensuring more than 50 thousand takeoffs or landings per annum are exceeded, the operator of the airport shall be obliged to propose a protective noise zone. Section 31, Paragraph 3 of the Act states that the airport operators shall be obliged to gradually carry out or ensure carrying out of anti-noise measures in such scope that the hygienic limits for noise are complied with at least inside residential buildings, family houses, schools and pre-school care facilities, facilities for health and social care and facilities for similar purposes. Shall the anti-noise measures, according to an expert assessment, not ensure compliance with hygienic limits, the competent administrative authority may commence a procedure on a change in use of the structure or remove thereof, as appropriate. [58]

Act No. 49/1997 Coll., on civil aviation and on amendment and supplement of **Act. No. 455/1991 Coll., on engaging in trade** (**The Trades Licensing Act**), as subsequently amended. According to Section 12, Paragraph 1, Letter c) of the Act it shall be prohibited to operate an aircraft in the airspace of the Czech Republic in the technical and operating condition that does not correspond to the requirements of safe aviation and environmental protection laid down by an implementing the regulation. According to Section 44, Paragraph 2 of the Act the use of Czech Republic airspace for flight may be restricted or prohibited above certain areas for environmental protection reasons and the health of the population. [59]

3.2.2. Government Regulation and Noise Limits

Government Regulation **No. 502/2000 Coll., on health protection against unfavorable effects of noise and vibrations**, as subsequently amended (217/2016 Call.). [60]

- According to Section 12, Paragraph 4 of the Regulation the limit of acoustic pressure A for the air traffic noise in the outer premises of residential structures is set at $\boldsymbol{L_{Aeq,T}} = 65$ dB for the daytime and $\boldsymbol{L_{Aeq,T}} = 55$ dB for the night time.

- The noise limit for wind turbines in night time is $L_{Aeq,T}$ = 40 dB (outside bedrooms) and $L_{Aeq,T}$ = 30 dB (inside bedrooms). The non-formal noise limit for low-frequency noise is $L_{pA,LF}$ = 20 dB (indoors), and $L_{pA,LF}$ = 25 dB in day time.
- The noise limit for other noise than traffic:
  - outdoor noise limit: $L_{Aeq,T}$ = 50 dB (day-time), $L_{Aeq,T}$ = 40 dB (night-time)
  - indoor noise limit: $L_{Aeq,T}$ = 40 dB (day-time), $L_{Aeq,T}$ = 30 dB (night-time)
- The noise limit for road traffic noise:
  - outdoor noise limit: $L_{Aeq,T}$ = 55 dB (day-time), $L_{Aeq,T}$ = 45 dB (night-time),
  - indoor noise limit: $L_{Aeq,T}$ = 45 dB (day-time), $L_{Aeq,T}$ = 35 dB (night-time)
- The noise limit for the noise from rail transport:
  - $L_{Aeq,T}$ = 55 dB (day-time), $L_{Aeq,T}$ = 50 dB (night-time)
- The noise limit for the noise from main roads:
  - $L_{Aeq,T}$ = 60 dB (day-time), $L_{Aeq,T}$ = 50 dB (night-time)
- The noise limit for the noise in rail protected zones:
  - $L_{Aeq,T}$ = 60 dB (day-time), $L_{Aeq,T}$ = 55 dB (night-time)
- The noise limit for an old noise load:
  - $L_{Aeq,T}$ = 70 dB (day-time), $L_{Aeq,T}$ = 60 dB (night-time)
- The noise limit for an old noise load on railways:
  - $L_{Aeq,T}$ = 70 dB (day-time), $L_{Aeq,T}$ = 65 dB (night-time)

3.2.3. Czech National Standards

Technical standards in the Czech Republic are formed either as Czech national technical standards (ČSN) or are taken over by the system CSN from International (ISO) and European (EN) Standards.

Czech office for standards, metrology, and testing (UNMZ) is responsible for the creation of Czech technical standards (ČSN) and the adoption of international technical standards. When drafting, adopting and approving ČSN, the internal rules of the Czech National Agency are proceeded, in particular through the Technical Standards Committees (TNK).

- **CSN 01 1600 Acoustics – Terminology [61]**
  - This original standard complements IEC 50 (801) with other important terms in order to ensure as much as possible the consistency between the current state of knowledge and the practice in the field of acoustics.
  - This standard contains other current terms used in acoustics, in particular in the standards relating to sound measurement methods, determination of noise emission, with particular reference to European standards C - test rules for noise, determination of noise pollution and areas of a building and spatial acoustics.
  - This standard has been developed as a supplementary tool for acoustics standards developers and refers to current revised standards.

3.3. German Noise Legislation

Traffic noise is considered as one of the main environmental problems in Germany. In order to improve protection against noise, environmental policies focus on the overall concept of sustainability. To Reducing noise at its source was acknowledged as the most efficient and sustainable strategy.

The following documents, which are part of the German legislation, are related to environmental noise or noise generated by working environment. Some documents are completely dedicated to noise, others devote to the noise some parts or the noise is only briefly mentioned there.

- **Act on the prevention of harmful effects on the environment caused by air pollution, noise, vibration and similar phenomena** (Federal Immission Control Act - BImSchG) *(Title in German: Gesetz zum Schutz vor schädlichen Umwelteinwirkungen durch Luftverunreinigungen, Geräusche, Erschütterungen und ähnliche Vorgänge (Bundes-Immissionsschutzgesetz - BImSchG))*
  - "The purpose of this Act to protect human beings, animals and plants, soil, water, the atmosphere as well as cultural objects and other material goods against any harmful effects on the environment and to prevent the emergence of any such effects." [62]
  - **Part VI** of this act is devoted to the **Noise Abatement Planning** and contains information about strategic noise mapping and noise action plans, which are considered as important new tools for noise protection in Germany. The noise maps will be prepared for all major roads, major railways, major airports, and agglomerations.
  - The main interest is environmental noise exposure in particular built-up areas, in public parks or other quiet areas in an agglomeration, in quiet areas in open country,

near schools, hospitals and other noise-sensitive buildings and areas. This act shall not apply to noise that is caused by the exposed person himself, noise from domestic activities, noise created by neighbors, noise at workplaces or noise inside means of transport or due to military activities in military areas.

- **Ordinance on the protection of workers against the risks arising from exposure to noise and vibrations (Noise and Vibrations Occupational Safety and Health Ordinance - LärmVibrationsArbSchV)** *(Title in German: Verordnung zum Schutz der Beschäftigten vor Gefährdungen durch Lärm und Vibrationen (Lärm- und Vibrations-Arbeitsschutzverordnung - LärmVibrationsArbSchV)* [63]
  - The scope of this ordinance is the protection of employees from risks to their health and safety which are caused by noise and vibration during work. A part of this ordinance is devoted to determination and assessment of risks. Another part deals with action values and noise protection measures, also hearing protectors are described. This ordinance sets exposure limit values, exposure action values and measures to protect against vibrations.
  - The action values in respect of the daily noise exposure levels and peak sound pressure level are as follows:
    - 1. Upper exposure action values: $L_{EX,8h}$ = 85 dB(A) and $L_{pC,peak}$ = 137 dB(C),
    - 2. Lower exposure action values: $L_{EX,8h}$ = 80 dB(A) and $L_{pC,peak}$ = 135 dB(C).
    - When applying the action values the attenuation provided by individual hearing protectors worn by the worker shall not be taken into account.

- **Act on Regulatory Offences (OWiG)** *(Title in German: Gesetz über Ordnungswidrigkeiten (OWiG))* [64]
  - Chapter two (Violation of public order) contains the section 117 which deals with inadmissible noise.

- **16th Federal Immission Protection Ordinance (The Traffic Noise Protection Ordinance - 16. BImSchV)** *(Title in German:* Sechzehnte Verordnung zur Durchführung des Bundes- Immissionsschutzgesetzes (***Verkehrslärmschutzverordnung - 16. BImSchV***) [65]
  - The ordinance implementing the Federal Immission Control Act deals with the construction of new roads and the expansion of existing ones and noise protection measures. This document provides immission limits in order to protect the neighborhood from

harmful environmental influences caused by traffic noise, the construction or substantial change.

- **24th Federal Immission Protection Ordinance (The Traffic Route and Sound Protective Measures Ordinance - 24. BImSchV)** *(Title in German:* Vierundzwanzigste Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (Verkehrswege-Schallschutzmaßnahmenverordnung - 24. BImSchV) [66]

- **4th Federal Immission Protection Ordinance (Ordinance on Installations Requiring a Permit - 4. BImSchV)** - *(Title in German:* Vierte Verordnung zur Durchführung des Bundes- Immissionsschutzgesetzes (Verordnung über genehmigungsbedürftige Anlagen - 4. BImSchV) [67]

- **6th General Administrative Provision to the Federal Immission Contr ol Act (Technical Instructions on Noise Abatement - TA Lärm)** *(Title in German:* Sechste Allgemeine Verwaltungsvorschrift zum Bundes-Immissionsschutzgesetz (Technische Anleitung zum Schutz gegen Lärm – TA Lärm) [68]

- **32nd Federal Immission Protection Ordinance (Equipment and Machinery Noise Regulation - 32.BImSchV)** *(Title in German:* 32. Verordnung zur Durchführung des Bundes- Immissionsschutzgesetzes (Geräte- und Maschinenlärmschutzverordnung - 32. BImSchV) [69]

- **34th Federal Immission Protection Ordinance (Regulation on Noise Mapping - 34. BImSchV)** *(Title in German:* 34. Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (Verordnung über die Lärmkartierung - 34. BImSchV) [70]

- **18th Federal Immission Protection Ordinance (Regulations on Noise Control in Sports Facilities 18. BImSchV)** *(Title in German:* Achtzehnte Verordnung zur Durchführung des Bundes- Immissionsschutzgesetzes (Sportanlagenlärmschutzverordnung - 18. BImSchV) [71]

- **The German Road Traffic Regulations (StVO)** *(Title in German: Straßenverkehrs-Ordnung (StVO))* [72]

- **The German Road Traffic Approval Order (StVZO)** *(Title in German: Straßenverkehrs-Zulassungs-Ordnung (StVZO))* [73]

- **Magnetic-levitation Train Noise Protection Regulations (MsbLärmSchV)** *(Title in German: Magnetschwebebahn-Lärmschutzverordnung (MsbLärmSchV))* [74]

- **The German Act for Protection against Aircraft Noise (FluLärmG)** *(Title in German:* Gesetz zum Schutz gegen Fluglärm (FluLärmG))
  - The scope of this act is to protect the public and the neighborhood from hazards, significant disadvantage and significant nuisance caused by aircraft noise in the surroundings of airfields by means of building restrictions and structural sound insulation. This document contains also noise limits listed below.[75]
  - Limit values for new civilian airfields or civilian airfields which have undergone substantial structural expansion [75]:
    - Daytime protection zone 1: $L_{Aeq,\ Day}$ = 60 dB(A), Daytime protection zone 2: $L_{Aeq,\ Day}$ = 55 dB(A)
    - Night-time protection zone: $L_{Aeq,\ Night}$ = 50 dB(A), L_{Amax} = 6x 53 dB(A)
  - Values for existing civilian airfields:
    - Daytime protection zone 1: $L_{Aeq,\ Day}$ = 65 dB(A), Daytime protection zone 2: $L_{Aeq,\ Day}$ = 60 dB(A)
    - Night-time protection zone: $L_{Aeq,\ Night}$ = 55 dB(A), L_{Amax} = 6 x 57 dB(A)
- **The first degree of implementation of the Act on Protection against Air-Craft Noise (1st FlugLSV)** *(Title in German:Erste Verordnung zur Durchführung des Gesetzes zum Schutz gegen Fluglärm (Verordnung über die Datenerfassung und das Berechnungsverfahren für die Festsetzung von Lärmschutzbereichen - 1. FlugLSV)* [76]
- **The second degree of implementation of the Act on Protection against Air-Craft Noise (2nd FlugLSV)** *(Title in German: Zweite Verordnung zur Durchführung des Gesetzes zum Schutz gegen Fluglärm (Flugplatz-Schallschutzmaßnahmenverordnung - 2. FlugLSV)* [77]
- **Airfield Noise Protection Regulations** *(Title in German: Landeplatz-Lärmschutz-Verordnung (Landeplatz-LärmschutzV)* [78]
- **The German Aviation Act (LuftVG)** *(Title in German: Luftverkehrsgesetz (LuftVG)* [79]
- **The German Aviation Regulation (LuftVO)** *(Title in German: Luftverkehrs-Ordnung (LuftVO)* [80]
- **The Regulation on the Certification and Licencing in Aviation (LuftVZO)** *(Title in German: Luftverkehrs-Zulassungs-Ordnung (LuftVZO)* [81]

3.3.1. The German Standards

As in the case of the Czech Republic, German standards are most often taken over from European and international standards. An overview of the most important types of standards used in Germany is listed below.

- **DIN** - The national standard which has exclusively or predominantly national significance or is published as a preliminary step to an international document. DIN standards are submitted for comment before their final approval of the specialist public. In this phase, they are referred to as draft designs and marked with the suffix "E".
- **DIN ISO, DIN IEC, DIN ISO / IEC** - German edition of an International Standard, issued by ISO and/or IEC, which has been incorporated into the German Standards Organization as it is.
- **DIN EN** - German edition of a European standard which has been adopted by all members of the European standardization organizations CEN / CENELEC / ETSI.
- **DIN EN ISO** - German edition of a European standard which is identical to an international standard and has been adopted by all members of the European standardization organizations CEN / CENELEC / ETSI.
- **DIN VDE** - Electrotechnical standards with safety-relevant or EMC-specific specifications (electromagnetic compatibility) are referred to as DIN standards with VDE classification in DIN standards.

In addition to standards, specifications are also used in Germany.

- **DIN SPEC** (pre-standard, technical report, PAS, CWA) - A specification contains specifications for physical or immaterial items of control or data, etc. from standardization or research projects. It is developed by temporary committees under the guidance of DIN or within the framework of CEN workshops, without necessarily involving all interested parties. Depending on the method used when creating the DIN SPEC, a distinction is made between DIN SPEC (pre-standard), DIN SPEC (technical report), DIN SPEC (PAS) and DIN SPEC (CWA).

In Germany, in addition to the standards adopted from international institutions, the following standards apply to noise issues.

- **DIN 45684-1 (2013-07)** Acoustics - Determination of aircraft noise exposure at airfields - Part 1: Calculation method *(Title in German: Akustik - Ermittlung von Fluggeräuschimmissionen an Landeplätzen - Teil 1: Berechnungsverfahren)* [82]

- DIN 45684-1 is used together with DIN 45684-2 to determine the aircraft noise exposure around existing or planned landing sites.
- The aim of this standard is to calculate the noise immission caused by most aircraft designs in the vicinity of existing or planned landing sites and to provide the basis for a subsequent assessment. For this purpose, the calculation method described in this standard provides, as a result, acoustic characteristic values at any location in the vicinity of the land field. The method is based on the division of aircraft into aircraft groups. In this standard, tabular data of the acoustic parameters and flight performances of the aircraft groups are provided for the immission calculation.

- **DIN 45684-2 (2015-12)** - Acoustics - Determination of aircraft noise exposure at airfields - Part 2: Determination of acoustic and flight operation parameters *(Title in German: Akustik - Ermittlung von Fluggeräuschimmissionen an Landeplätzen - Teil 2: Bestimmung akustischer und flugbetrieblicher Kenngrößen)* [83]
  - The standard describes an emission measurement method for the determination of acoustic and flight operating parameters, which can be included in the calculation method according to DIN 45684-1. These measurements may be necessary in particular cases, for example when the aircraft operation of an aircraft group is dominated by individual aircraft models and this must be considered separately. During the measurements, the flight conditions start, landing and horizontal flight are recorded separately.
  - DIN 45684-2 applies only to ultra-light airplanes, motor sailers and propeller aircraft with a maximum permissible take-off mass of up to 8 618 kg and for helicopters with a maximum permitted take-off mass of up to 10 000 kg.

- **DIN 45687 (2006-05)** - Acoustics - Software products for the calculation of the sound propagation outdoors - Quality requirements and test conditions *(Title in German: Akustik - Software-Erzeugnisse zur Berechnung der Geräuschimmission im Freien - Qualitätsanforderungen und Prüfbestimmungen)* [84]
  - The standard has been prepared by the Special Advisory Committee "Quality Requirements and Test Conditions for Soundproofing Software for Immission Control" in NALS. In addition to DIN 66272, DIN EN ISO 9000-3 and DIN ISO / IEC 12119, it contains quality requirements and test conditions for the computer-assisted calculation of the sound propagation in the open air on the basis of corresponding regulations.
  - The standard specifies the framework conditions for a generally valid data format, which allows the exchange of data between different applications by means of computer

programs and the specification of the conformity with related rules. The test shall be carried out on the basis of test tasks and taking into account statistical procedures.

- **DIN 45688 (2014-07)** - Specific requirements for the competence of testing laboratories for noise and vibration in the field of immission control *(Title in German: Besondere Anforderungen an die Kompetenz von Prüflaboratorien für Geräusche und Erschütterungen im Bereich des Immissionsschutzes)* [85]
  - This standard specifies specific requirements for test points for noise and/or vibrations in the area of the Federal Immission Control Act (BImSchG), which relate to installations, construction sites, road and rail traffic and - only for noise - to inland waterway transport.
  - In section 4, this standard specifies the general requirements laid down in DIN EN ISO / IEC 17025 for test bodies and in section 5 the mandatory regulations in the area of noise control and noise.
  - This standard is addressed to bodies responsible for accreditation and notifications in the field of noise and/or vibrations, and to inspection bodies which are subject to accreditation or notification in these areas.
- **DIN 45642 (2004-06) -** Measurement of traffic noise *(Title in German: Messung von Verkehrsgeräuschen)* [86]
  - The standard describes methods for determining the sound emission and the sound immission of a road, rail and waterway traffic on existing traffic routes. The sound emission is described by the emission level. This is calculated from the measured variables single event level or maximum sound pressure level caused by a passing vehicle. The sound immission is described by the mean level (equivalent sound level). This is measured directly in streets. For railways and waterways, the average level is calculated from the measured single event levels. The standard is divided into the main sections "Emission measurements" and "Immission measurements". These two main sections are divided into the parts "road traffic noise", "rail traffic noise" and "water traffic noise". The standard has been prepared by the NALS Working Committees.
- **DIN SPEC 45660-1 (2014-05)** - Guide for handling uncertainty in acoustics and vibration - Part 1: Uncertainty of acoustical quantities *(Title in German: Leitfaden zum Umgang mit der Unsicherheit in der Akustik und Schwingungstechnik - Teil 1: Unsicherheit akustischer Kenngrößen)* [87]

  - This specification, in the sense of a specialist report, is a guide for the determination of the uncertainties of measured or projected acoustic parameters as well as the use of the uncertainties when comparing with requirements. The guide deals in particular with aspects of quality, environmental protection, building acoustics and occupational health and safety. The terminology and the information provided in this document should be considered in the development of standards in an acoustic field, such as standards for sound emission, immission, building acoustics, acoustic product features acoustic instruments. DIN SPEC 45660-1 is closely related to ISO / IEC Guide 98-3 "Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)".

- **DIN SPEC 45660-2 (2015-08)** - Guide for dealing with uncertainty in acoustics and vibration - Part 2: Uncertainty of vibration quantities *(Title in German: Leitfaden zum Umgang mit der Unsicherheit in der Akustik und Schwingungstechnik - Teil 2: Unsicherheit schwingungstechnischer Größen)* [88]
  - The guide defines procedures for determining the uncertainty of measured, calculated or projected vibration characteristics quantities. In addition, this guideline specifies how to deal with the uncertainty when comparing calculated values with requirements. This guide can be used in the determination of the uncertainty of vibrational quantities in practice as well as in the preparation of standards for the various fields of application.

- **DIN 18005-1 (2002-07)** - Noise abatement in town planning - Part 1: Fundamentals and directions for planning *(Title in German: Schallschutz im Städtebau - Teil 1: Grundlagen und Hinweise für die Planung)* [89]
  - The standard provides information on the consideration of sound insulation in urban planning. It is aimed at municipalities, urban planners, architects and building inspectors.

- **DIN 45641 (1990-06)** - Averaging of sound levels *(Title in German: Mittelung von Schallpegeln)* [90]
  - The standard defines the average level of sound events and provides methods for its determination.

- **DIN 45645-1 (1996-07)** - Determination of rating levels from measurement data - Part 1: Noise immission in the neighbourhood *(Title in German: Ermittlung von Beurteilungspegeln aus Messungen - Teil 1: Geräuschimmissionen in der Nachbarschaft)* [91]

- This standard describes the method for determining assessment levels from measurements of noise immission in the neighborhood. Assessment levels are used to assess noise pollution, in particular by comparison with immission directives, which are laid down in relevant regulations, regulations or directives.

- **DIN 45645-2 (2012-09)** - Determination of rating levels from measurement data - Part 2: Determination of the noise rating level for occupational activities at the workplace for the level range underneath the given risk of hearing damage *(Title in German: Ermittlung von Beurteilungspegeln aus Messungen - Teil 2: Ermittlung des Beurteilungspegels am Arbeitsplatz bei Tätigkeiten unterhalb des Pegelbereiches der Gehörgefährdung)* [92]

  - This document describes a method to detect the noise immission at workplaces in activities with increased requirements, for example, concentration, and to determine suitable noise-immission characteristics for the assessment of nuisance and disturbance (extraaural effects). So that the noise emissions are independent of the type and their origin comparable.

- **DIN 45680 (2013-09)** - Measurement and assessment of low-frequency noise immissions (Formerly under the title: Measurement and assessment of low-frequency noise immissions in the neighborhood) *(Title in German: Messung und Bewertung tieffrequenter Geräuschimmissionen in der Nachbarschaft)* [93]

  - The document describes a method for measuring and evaluating low-frequency noise immission in the air and/ or body-borne sound transmission. It is intended to complement the existing measurement and assessment procedures for noise and to assess low-frequency noise immunities to protect against considerable nuisances.

- **DIN 45681 (2005-03)** - Acoustics - Determination of tonal components of noise and determination of a tone adjustment for the assessment of noise immissions *(Title in German: Akustik - Bestimmung der Tonhaltigkeit von Geräuschen und Ermittlung eines Tonzuschlages für die Beurteilung von Geräuschimmissionen)* [94]

  - In this standard, a method for objective determination of the tonality of noise and for determining a "tone addition" for the evaluation of noise levels is described. The standard supplements the normal method for evaluation according to the hearing impression, particularly in cases where there is disagreement about the level of tonality. The described method is applicable when the frequency of the tone to be evaluated is equal to or higher than 90 Hz and amplitudes and frequencies are substantially constant. The standard describes the practical application of the defined method on

the basis of corresponding application examples. This is shown by means of a pumping system, an internal combustion engine, and a wind energy installation. The standard is distributed together with a basic program developed under Microsoft ExcelR.

- **DIN 45682 (2016-06)** - Acoustics - Thematic maps in the field of sound immission protection *(Title in German: Akustik - Thematische Karten im Bereich des Schallimmissionschutzes)* [95]
  - This document deals with the graphical representation of sound immissions as well as the data necessary for their determination, interpretation and further use. This document is intended to show the existing possibilities, to systematize them, to create a uniform and expertized way of naming, thus contributing to a clear language rule. Thus the conflict-free dialogue between clients and contractors or between preparers and users of noise maps is supported. Furthermore, regulators are allowed to formulate clearly desired requirements for the noise maps to be generated with reference to this document.

Part II.

Practical Part

4. Objectives

The specific aim of this thesis is to provide answers to following questions:

- **How does it relate, from which socio-economic group do people come from and what is their perception of noise annoyance?**
- **What is the relationship between socio-economic factors and satisfaction with the quality of life?**

The main objective of this thesis is to identify the most annoying environmental noise sources and their impacts on the perception of the quality of life. A further area of the research is the comparison of the noise impact on the perception of the quality of life in two EU countries.

Another objective of this work is to prepare a proposal for a methodology for municipalities, which can be used to quickly and easily determine the satisfaction of the population with the quality of life and the noise burden in the given municipality.

To meet the objectives of this thesis and to find the answers to the questions mentioned above was following procedure chosen:

1. Summarize the European, German and Czech noise legislation.
2. Prepare a survey to gain data. -> Prepare a questionnaire and interview questions in Czech and German languages.
3. Realize a survey focused on the perception of noise annoyance and the quality of life in the Czech Republic.
4. Realize a survey focused on the perception of noise annoyance and the quality of life in Bavaria.
5. Analyze the survey data and compare the results of the two surveys.
6. Identify the areas most annoyed by the environmental noise.
7. Interview the people in the highly annoyed areas about the noise impacts on the life quality.
8. Design the methodology for the local authorities.

5. Experiments

5.1. Survey Design

The aim of the experimental part was to investigate which type of environmental noise like for instance road traffic noise, aircraft noise, wind turbine noise or other noise, is the most annoying for people living in the Czech Republic and Germany. Furthermore, the environmental noise impacts on the quality of life of people living in environmental noise affected areas shall be identified and compared with other factors influencing the quality of life.

For data collection, two surveys were designed and several interviews were conducted with local authorities and the groups objecting noise caused by wind turbine or aircraft. The survey data has been analyzed and checked for possible misrepresentation. The results are presented in the following.

The first survey was carried out in the Czech Republic in April 2017 and the second survey in Bavaria in Germany in Mai 2017. Both surveys were designed in such way that a sufficient number of responses was obtained. This entails a robust sample to provide relevant results. The responses should be collected from diverse groups of respondents including males and females in a range of age groups with various education level, employment and marital status from various sizes of municipalities living in households with various numbers of members.

About 30 % of participants in the first survey in the Czech Republic were personally interviewed and they fulfilled the paper form of the questionnaire. The bigger part of the survey data was collected using the online form of the questionnaire. The questionnaire was sent per Email and posted in social media. The author of this thesis chose to use a more personal approach when addressing participants of the survey to minimize the risk of the low response rate of online surveys. A total number of processed responses from the Czech Republic amounts to 270. The same proportion of paper and online questionnaires was kept also by the second survey in Bavaria. A total number of the evaluated questionnaires from Bavaria is 100.

5.1.1. Questionnaire

Both questionnaires had been designed to ensure anonymity and the completion of the questionnaire was voluntary. The participants of the survey did not need to answer all the questions

when they were uncomfortable with them. Some questions could have been skipped if the topic didn't apply to the participants. All obtained data was treated as confidential and only used for scientific purposes.

Another defined risk of the online surveys is that the views of the people who didn't participate in the survey could differ from those who respond. That is why the questionnaire was designed to get the information in very general terms.

The Czech and German version of the questionnaire is shown in Annex and **A. Questionnaire for The Czech Republic** and **B. Questionnaire for Bavaria.** The online version can be seen in Annex **D. Questionnaire - online version - examples in Czech and German language**.

The questionnaire is divided into 4 parts.

Part 1 - Quality of life

The first part contains 6 questions which are devoted to satisfaction with the respondents' housing.

- In Question 1 and Question 2 are the respondents asked, where do they live and how long.
- The Question 3 inquiries where did the participants live before and which reasons they had to move. This question is optional and the participants who have not moved recently can skip it.
- The Question 4 asks whether participants have lately intended to move. If they answer yes, they are asked in two sub-questions to mention the reasons to move and the arguments which could persuade them to stay.
- Question 5 investigates how important are for the participants and their household some factors, which could influence their quality of life. And they can choose from the following options by each of the factors:
    - Extremely important
    - Very important
    - Moderately important
    - Slightly important
    - Not at all important
- Question 6 inquires how satisfied are the participants with the listed factors in their local area. One other factor can be also added by the participants. The options to choose were:

- Very satisfied
- Satisfied
- Neither satisfied nor dissatisfied
- Dissatisfied
- Very Dissatisfied

Quality of Life Factors: [1]

- Street cleanliness
- Quality of local schools
- The amount of road traffic
- Road traffic noise
- Quality of the air
- Aircraft noise
- Condition of roads and pavements
- Availability of local restaurant/ cafés
- Availability of local medical care
- Level of local crime
- Access to local shops
- Feelings of personal security
- Wind turbine noise
- Access to public transport
- Access to jobs
- Access to green spaces/ countryside
- Other

[1] *Most of the used quality of life factors in this survey correspond to the factors used in a community survey which was undertaken by FaberMaunsell on behalf of the Belfast City Airport in 2003.* [96] *The results of the survey should have assisted the Airport in the development of its noise control and community impacts program. The survey was commissioned following research by Manchester Metropolitan University (MMU), where the author of this thesis was in 2012 on an internship.*

Part 2 - Noise in the Local Environment

The second part includes ten questions which are devoted to the noise in the participants' neighborhood.

- Question 7 inquires how often do the participants notice noise from listed noise sources when they are at home. The participants can add any other noise source.

  Noise sources: [2]

  - Burglar/ car alarms
  - Neighbours
  - Dog barking
  - Children playing
  - Motorbikes/ mopeds
  - Noisy people at night
  - Road traffic noise
  - Trains
  - Aircraft
  - Wind turbine
  - Sirens
  - Factory/ construction
  - Other

  Options:

  - Never
  - Seldom
  - Sometimes
  - Often
  - All the time

- Question 8 asks how noisy do the participants consider the listed noise sources.

[2] *Most of the listed noise sources in this survey correspond with the noise sources used also in the community survey which was undertaken by FaberMaunsell on behalf of Belfast City Airport in 2003.* [96]

- Question 9 asks how noisy do the participants consider the place where they live.

  Question 8 and 9 have the same options to answer:

  - Not at all
  - Slightly
  - Moderately
  - Very
  - Extremely

- Question 10 inquires how did the noise level in the areas, where the respondents live, change in last 12 months.

  The participants can choose from 3 options:

  - Increased
  - Stayed about the same
  - Decreased

- Question 11 finds out how do the participants consider themselves sensitive to noise.

  - Less sensitive
  - About the same sensitive
  - More sensitive

- Question 12 inquires how annoying was the noise from listed sources in last 12 months when the participants were at home.

- Question 13 explores how annoying is the noise in the place where the participants live in total. The options used by Questions 12 and 13 are the same as by questions 8 and 9.

- Question 14 focuses on the daytime that a participant spent at home at:

  - Early mornings (6-9)
  - Daytime (9-18)
  - Evenings (18-22)
  - Nights (22-6)
  - On Saturdays
  - On Sundays

The options are:

- Never
- Rarely
- Sometimes
- Usually
- Always

- Question 15 finds out whether the participants notice that noise from different sources and whether it disturbs their activities when they are at home.

The Question 15 includes four sub-questions. Each sub-question focuses on another noise source - Road Traffic Noise, Aircraft Noise, Wind turbine Noise and Other Noise. The options are simply yes or no.

- Question 16 finds out if a noise source causes the respondents to undertake any of the listed actions. This Question is also divided into four sub-questions and each sub-question focuses on one of the four noise sources. And the options are also simply yes or no.

Part 3

This part was included in the questionnaire to find out the current state of health of the respondents and whether they find the place where they are at the moment convenient. The actual mood and comfort feeling of the participants may have an impact on the answers. The third part consists of five questions.

By questions A1 - A4 are participants offered a scale on which they can mark a vertical line with a spot that is either a few or more distant to faces that correspond to their current feeling.

- Question A1 How are you feeling today in terms of your health?
- Question A2 How do you consider the temperature in your current location?
- Question A3 How noisy would you say is your current location?
- Question A4 How do you consider the amount of fresh air in your current location?
- Question A5 Where did you fulfilled this questionnaire?

  The question A5 offered following 5 options:

  - At home

- At work
- In public transport
- In Café or Restaurant
- In another place

Part 4 - Demographic questions

The last part of the questionnaire contains ten demographic questions about sex, age, education level, marital status, household and its members, the size of a municipality where the participants live, social status and satisfaction with the monthly income. The overview of the both groups of respondents is described in the sections 5.2 and 5.4 .

5.2. Profile of the Survey Participants from the Czech Republic

The questionnaire was fulfilled in all 14 Regions of the Czech Republic. People from 94 Czech and Moravian towns and villages took part in this survey. More than 50% of all responses were obtained from Pilsen and Prague-City regions. The primary focus of the present data collection was in Pilsen Region. Exactly 100 responses from this region were processed. The rest of the answers is almost evenly divided between other regions. Percentage representation of each region is shown in the **Fig. 5.1.**

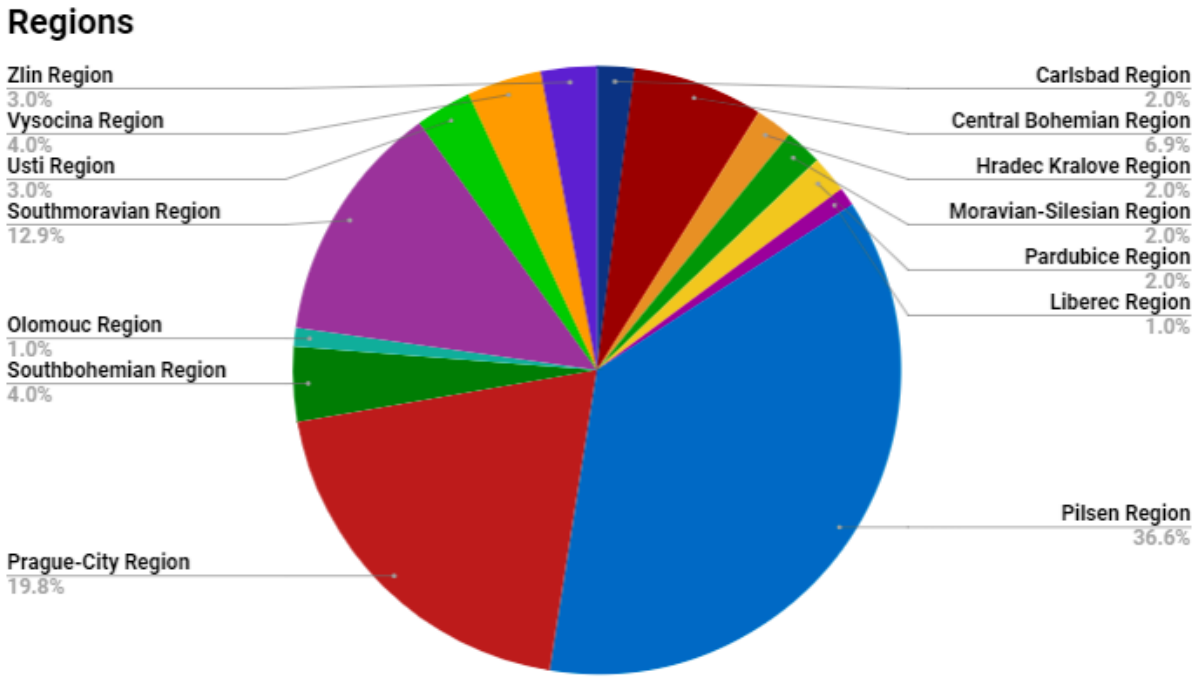

Figure 5.1.: Percentage Representation of the Czech Regions in the Survey

Almost 50% of participants live in municipalities with 100 000 and more inhabitants. The second largest group of participants stays in towns and villages which have between 1000 and 4999 inhabitants. The remaining 30% of participants are evenly divided into municipalities of sizes "up to 999 inhabitants", "5000 - 19 999 inhabitants" and "20 000 - 99 999 inhabitants." In the **Fig. 5.2** can be seen the division of participants into municipality sizes.

The respondents, who participated in the first survey, reside at their current address on average 12 years. Roughly 33% of respondents have moved to a new residence within the last five years. In the case of these answers, the reasons that led to their moving were evaluated.

As extremely or very important reasons mentioned 56% of recently moved respondents affordable housing. About 48% people stated quality of housing and 47% quality of neighborhood as an

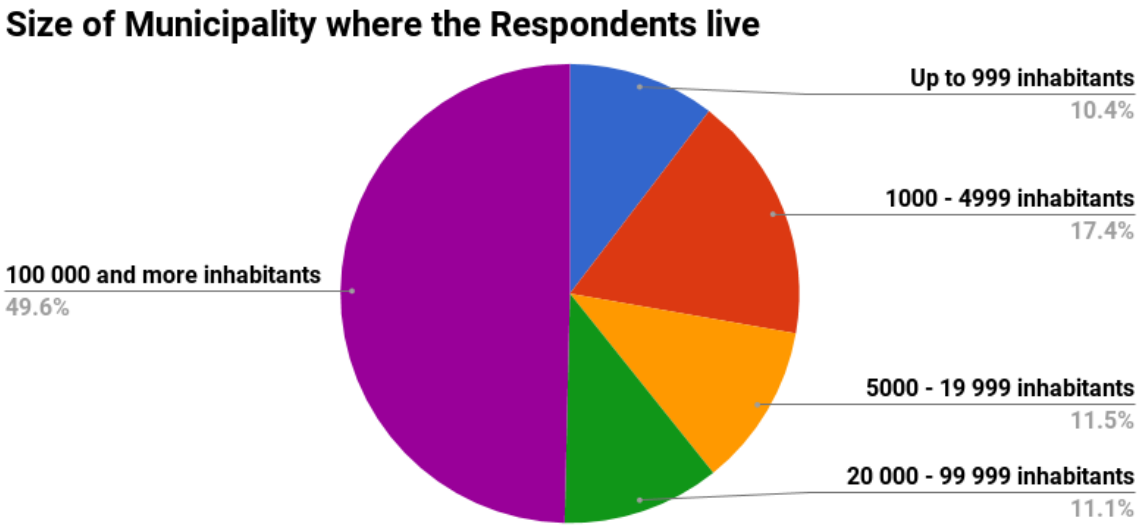

Figure 5.2.: Percentage of Respondents living in Municipalities with different Sizes

extremely or very important reason. Access to work was mentioned in 32% of cases and access to schools in 27% of cases as extremely or very important. At the same time, these two reasons were most often referred to as the least important. Access to schools was stated in 49% cases as not at all important and access to work in 32 % of the evaluated cases. For 84 % of recently moved respondents were extremely important other reasons such as cohabitation with a partner, independence from parents or unsuitable apartment size.

About 35% of all respondents have considered moving away from their current area recently. The most commonly mentioned reasons for moving are independence or own place for living (20%), access to work (19%), unsuitable apartment size (14%), cohabitation with a partner (11%), annoying roommates or neighbors (4%). Dissatisfaction with the quality of the environment was stated by 19% of respondents and deals mostly with environmental noise (road traffic, wind turbines) or air quality. The most frequently mentioned argument, which, in spite of the above-mentioned reasons, caused the respondents to stay at the place of their current residence is the lack of money or improving environmental quality.

In the first survey participated nearly the same number of males and females from the Czech Republic. The total of males reached 50,7% and the total of females reached 49,3%. The age spectrum of participants is quite diverse. About 79% of the participants fall into the two youngest age groups between 15 and 35 years old. The youngest accepted participant of the survey is 15 years old and the oldest one is 83 years old. Age stratification of respondents can be seen in the **Fig. 5.3**.

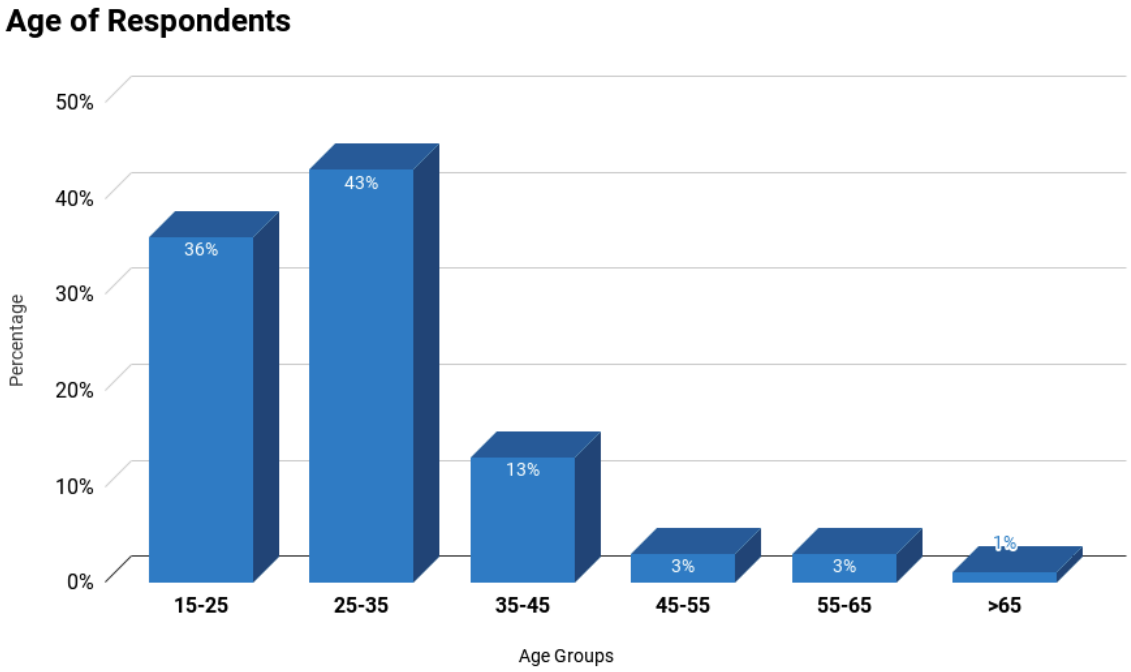

Figure 5.3.: The Number of Respondents in each Age Group

The survey also monitored the level of education, employment status and marital status of the participants answering the questionnaires, One set of questions was dedicated to the size of households and representation of economically active members as well as children without own income living in them. Another of the demographic issues was focused on satisfaction with the amount of income.

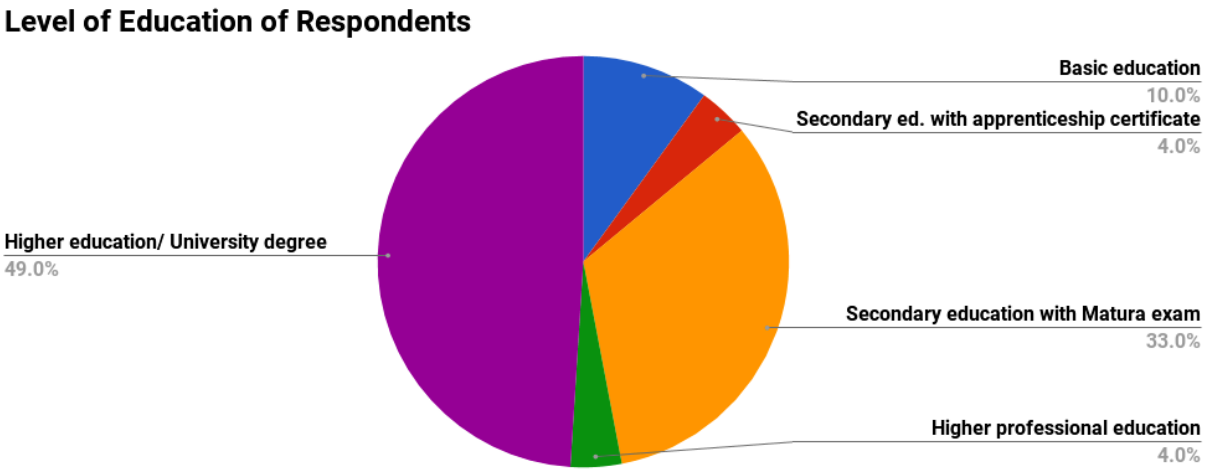

Figure 5.4.: Percentage of Education Level of Respondents

The first survey managed to gather responses from various people who create an interesting and diverse socio-economic group. That is especially expressed in the **Figures 5.4, 5.5** and **5.7**.

The proportion of university-educated respondents in the survey is higher than that prevalent in the Czech population according to the census taken in 2011. The document "The level of education of the population of the Czech Republic according to the census results in 2011" shows about 12.5% population with any university degree, 4% of people with higher professional education, 27% with a secondary education with Matura exam and 33% with a secondary school with an apprenticeship certificate. Only basic education should have about 18% of people in the Czech Republic. In the survey participated 49 % people with higher education or university degree, 33 % of people with secondary education with Matura exam, 4 % people with secondary education with apprenticeship certificate and 10 % of people have only basic education. [97]

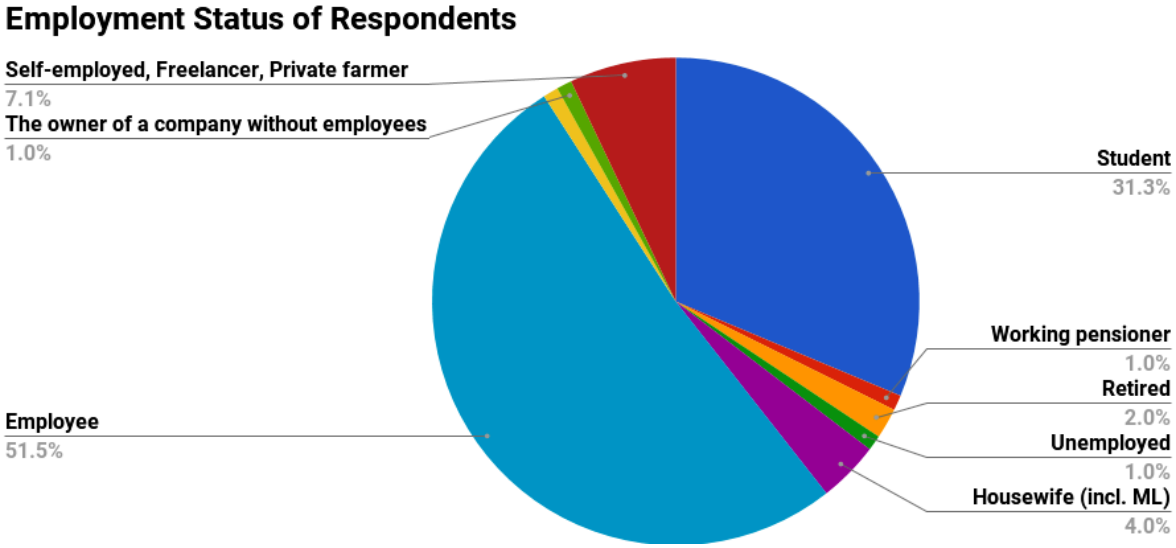

Figure 5.5.: Percentage of the Employment Status of Respondents

Answers to the question about the social status of respondents contain all available options. Approximately 52% of the survey participants are employed and 31 % of the participants are still students. Representation in other categories is shown in the **Fig. 5.5.** Every participant also expressed the satisfaction with the amount of his or her monthly income as depicted in **Fig. 5.6**.

In the **Tab. 5.1** are the percentages of satisfaction with Monthly Income clearly stated for each employee status. Almost 40% of the participants of the survey answered, that they are very satisfied or satisfied and about 37 % is quite satisfied with the monthly income. Dissatisfied with the financial situation is almost 18% of all respondents and 5,6% are very dissatisfied.

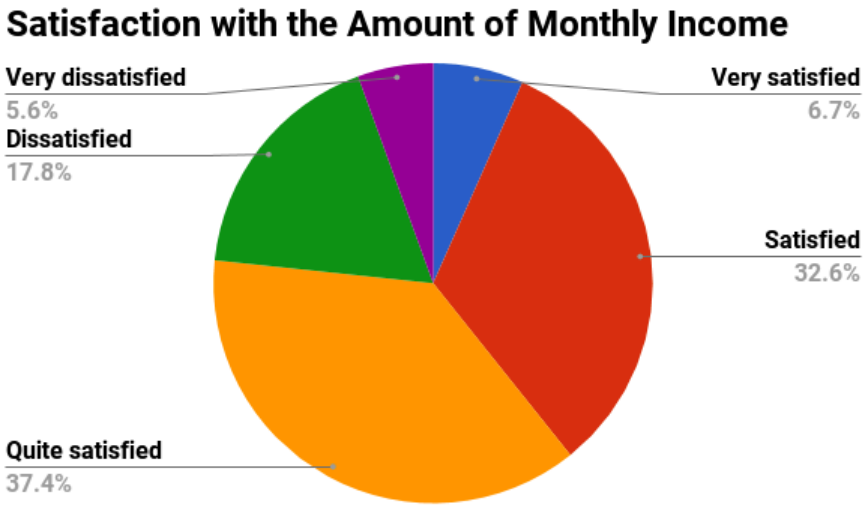

Figure 5.6.: Percentage of the Satisfaction with the Amount of Monthly Income of Respondents

Table 5.1.: Percentage of Satisfaction with the Amount of Monthly Income by the Employment Categories

	Satisfaction with Monthly Income				
Employment Status	**Very satisfied**	**Satisfied**	**Quite satisfied**	**Dissatisfied**	**Very dissatisfied**
Student	5%	23%	41%	22%	10%
Working pensionier	0%	50%	50%	0%	0%
Retired	17%	17%	50%	17%	0%
Unemployed	0%	33%	0%	33%	33%
Housewife	0%	10%	50%	30%	10%
Employee	7%	39%	34%	17%	4%
Self-employed, Freelancer, Private farmer	15%	30%	45%	10%	0%
The owner of a company without employees	0%	100%	0%	0%	0%
The owner of a company with employees	0%	50%	50%	0%	0%

From the perspective of family status, are in the survey represented all offered categories. More than 60% of respondents live with a partner either in marriage or any other cohabitation. Almost one-third of the participants are single, 5 % is divorced and 1% of them live after losing a wife or husband alone.

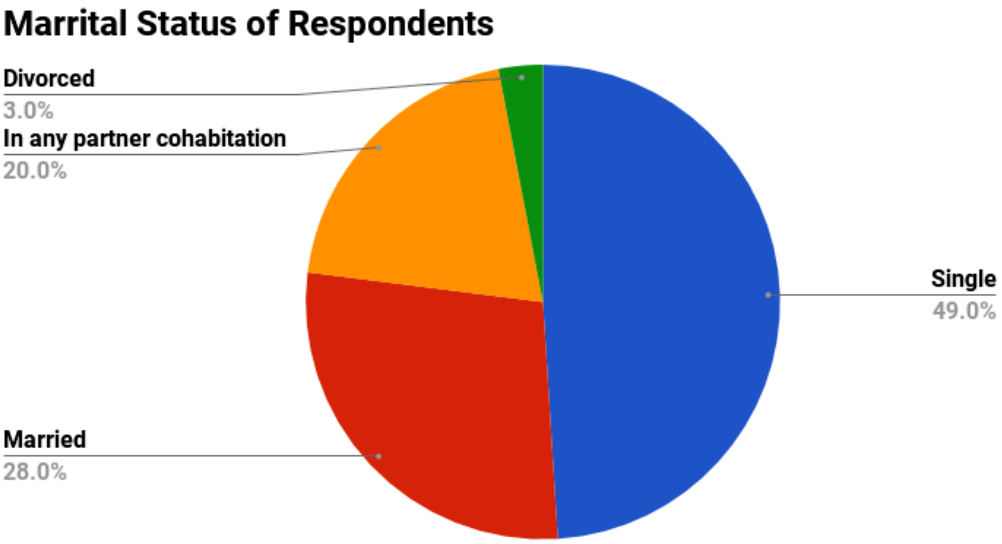

Figure 5.7.: Percentage of the Marital Status of Respondents

For the completion of the profile of the participants is illustrated in the **Fig. 5.8**, how big the households in which the respondents live are. The members of respondents' households are described in the **Fig. 5.9** and in the **Fig. 5.10**.

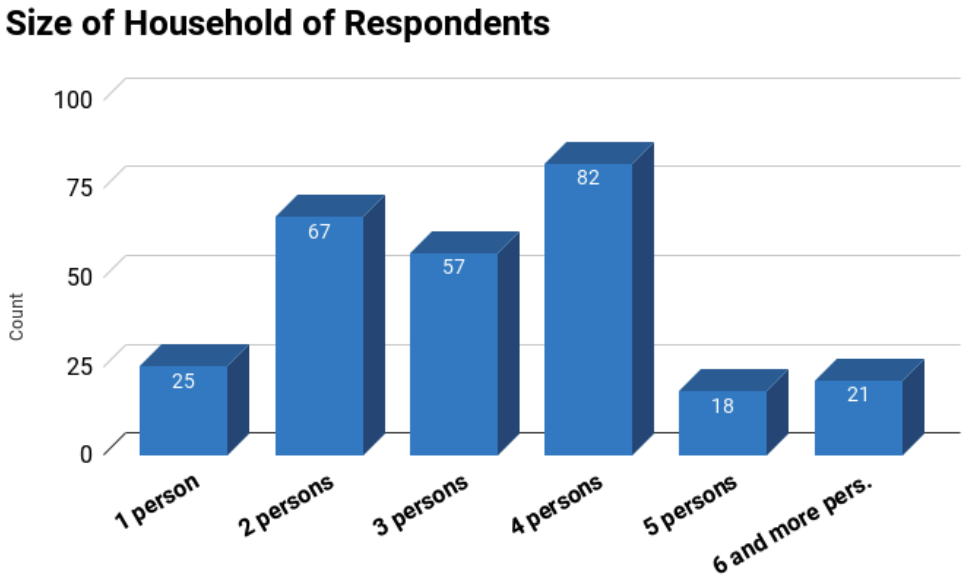

Figure 5.8.: Percentage of Respondents living in different Household Sizes

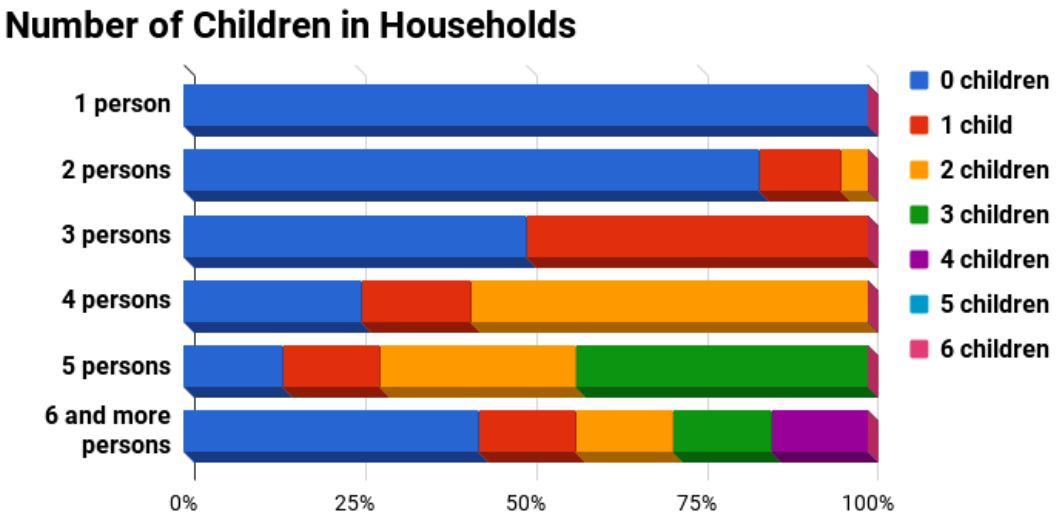

Figure 5.9.: The Number Children without own Income living in Participants Households

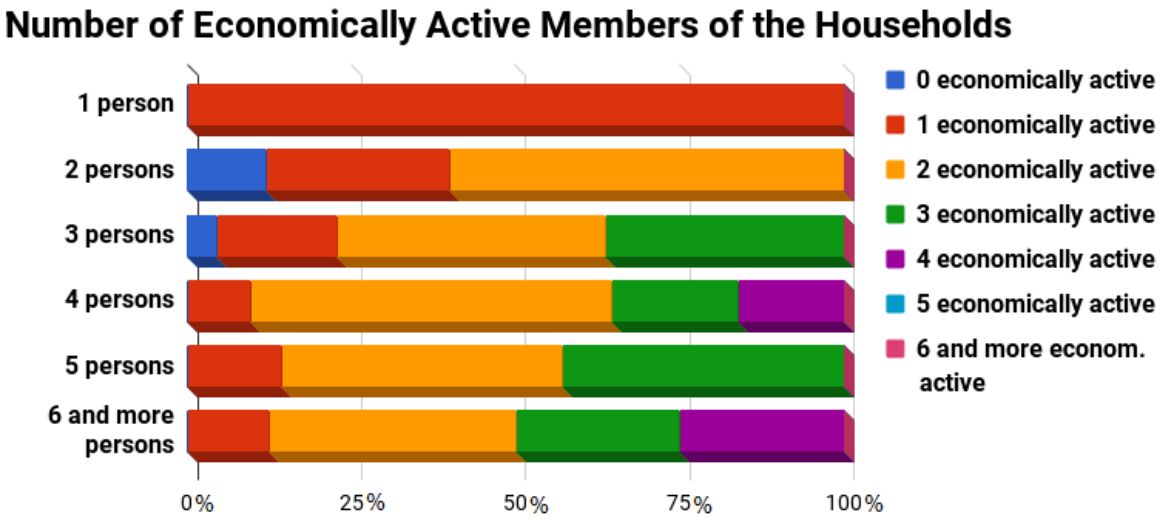

Figure 5.10.: The Number of Economically Active Members living in Participants Households

All these profile questions are further elaborated on in evaluating the main part of the questionnaire.

5.3. Health and Comfort of the Participants from the Czech Republic

The third part of the questionnaire precedes the previously mentioned demographic issues. To find out the current state of health of the respondents and whether they find the place where they are at the moment convenient, the scale was divided into ten segments. For each question was measured in which section the marked answer belongs to.

About 54 % of the questionnaires were completed at home, 17% at work, 1% in public transport and 27% in another place.

Satisfaction with temperature, noise level and the amount of fresh air in the place where the respondents fulfilled the questionnaire is displayed in the figures below including a statement on how healthy the participants feel at the moment.

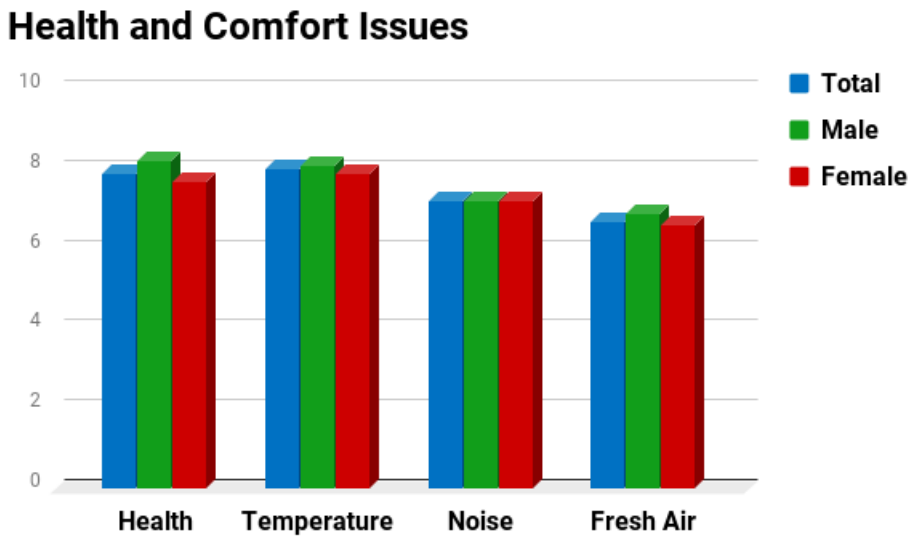

Figure 5.11.: Health and Comfort Issues by Males and Females (Czech Republic)

The **Fig. 5.11** shows how are these questions evaluated totally, by males and by females. In the **Fig. 5.12** can be seen the differences between age categories. And in the **Fig 5.13** are shown the places where the participants fulfilled the questionnaire and the evaluation of these places.

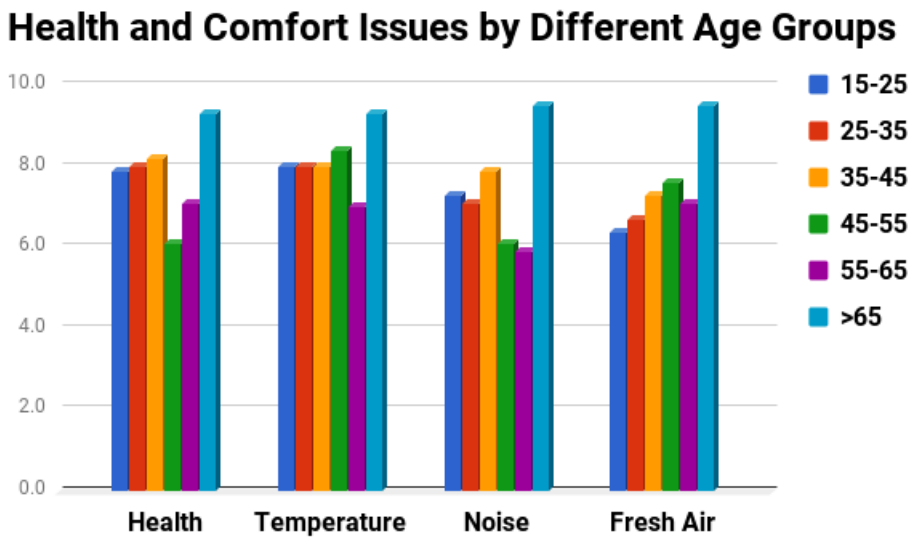

Figure 5.12.: Health and Comfort Issues by Different Age Groups (Czech Republic)

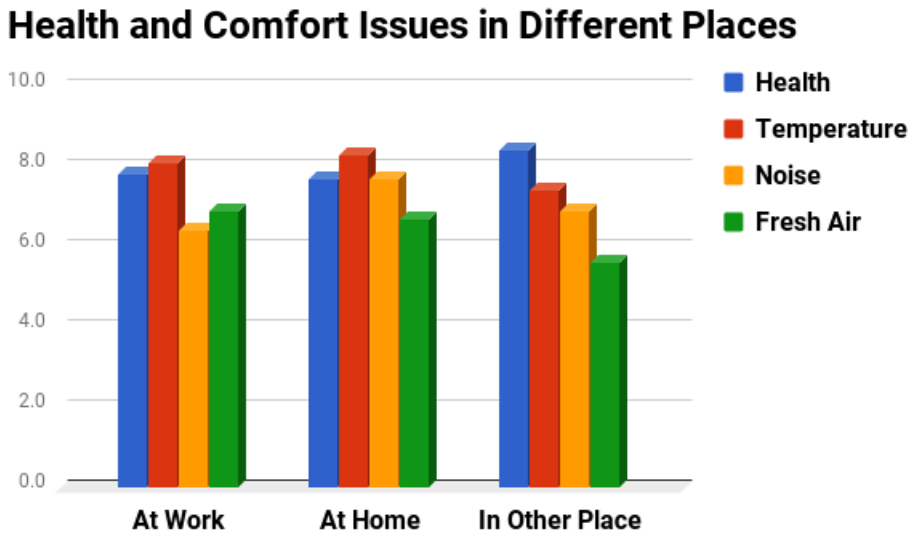

Figure 5.13.: Health and Comfort Issues in Different Places (Czech Republic)

5.4. Profile of Survey Participants from Bavaria

In the second survey, more than 100 people participated from Germany. In the present work, a comparable number of the inhabitants in Bavaria and in the Czech Republic shall be ensured. Therefore, exactly 100 responses from people living directly in Bavaria were evaluated. It is assumed that both neighboring countries could have similar noise problems. The responses came from 47 Bavarian towns and villages.

The profile of Bavarian respondents differs from the profile of the Czech respondents in several categories. Bavarian respondents came mainly from smaller municipalities what is shown in the **Fig. 5.14.** Only 12% of the Respondents live in Municipalities with "100 000 and more inhabitants". The largest group of respondents lives in towns with "between 20 000 and 99 999 inhabitants". The municipalities with the size of "from 5000 to 19 999 inhabitants" occupy about 18 % of respondents. In the municipalities "between 1000 and 4999 inhabitants" stay 24% of survey participants and in the smallest municipalities "up to 999 inhabitants" live 11%.

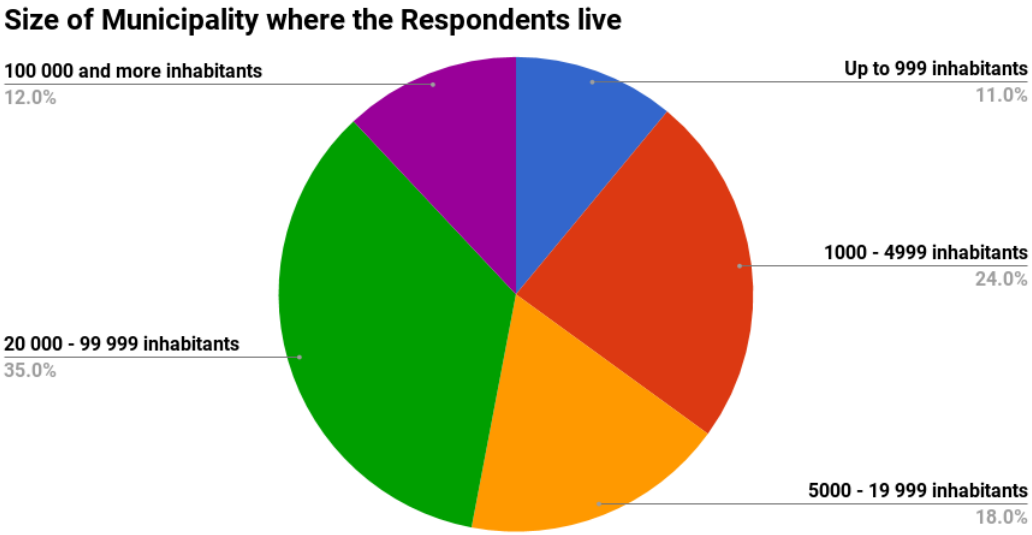

Figure 5.14.: Percentage of Respondents from Bavaria living in Municipalities with different Sizes

The respondents from the second survey, live at their current address on average eight years. About 33% of respondents have moved to a new residence within the last five years. By involved answers, the reasons that led to their moving were evaluated.

As the most important reasons to move to the current place were stated the quality of housing and the quality of the neighborhood. About 84% people evaluated the quality of housing as

extremely or very important. The quality of neighborhood was evaluated as extremely or very important for 70% of participants responding the question Q3. As extremely or very important reasons mentioned 62% of recently moved participants affordable housing. Access to work was mentioned in 42% of the evaluated cases and access to schools only in 14% of the evaluated cases as extremely or very important. Access to schools was also stated in 57% cases as not at all important. 81% of recently moved respondents consider other reasons such as cohabitation with a partner, own place for or unsuitable apartment size as extremely important.

Moving away from the current area have recently considered only 17 % of people. The most commonly mentioned reasons for moving are independence or own place for living, unsuitable apartment size, access to work, cohabitation with a partner.

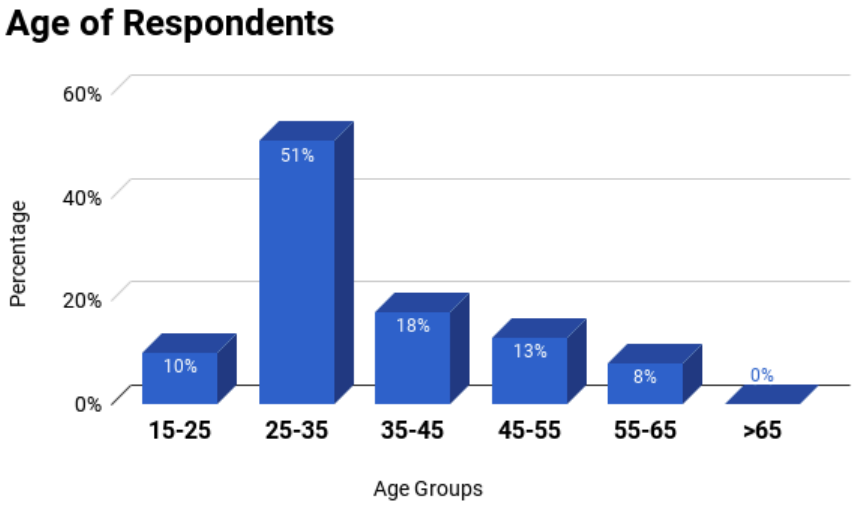

Figure 5.15.: The Number of Respondents from Bavaria in each Age Group

The questionnaire in Bavaria was fulfilled by 54 women and 46 men. The age spectrum of the participants is also quite diverse and it is shown in the **Fig. 5.15**. The second youngest group (25-35 years old) is the largest one and includes 51% of respondents. The youngest accepted participant of the survey is 18 years old and the oldest one is 60 years old.

More than half of the respondents who participated in the survey in Bavaria reached Higher education or University degree. The least numerous group of the respondents reached higher professional education, 8% people ended secondary education with Matura exam, 21% of the respondents have a secondary education with apprenticeship certificate and 9% of people have only basic education. The whole overview is shown in the **Fig. 5.16.**

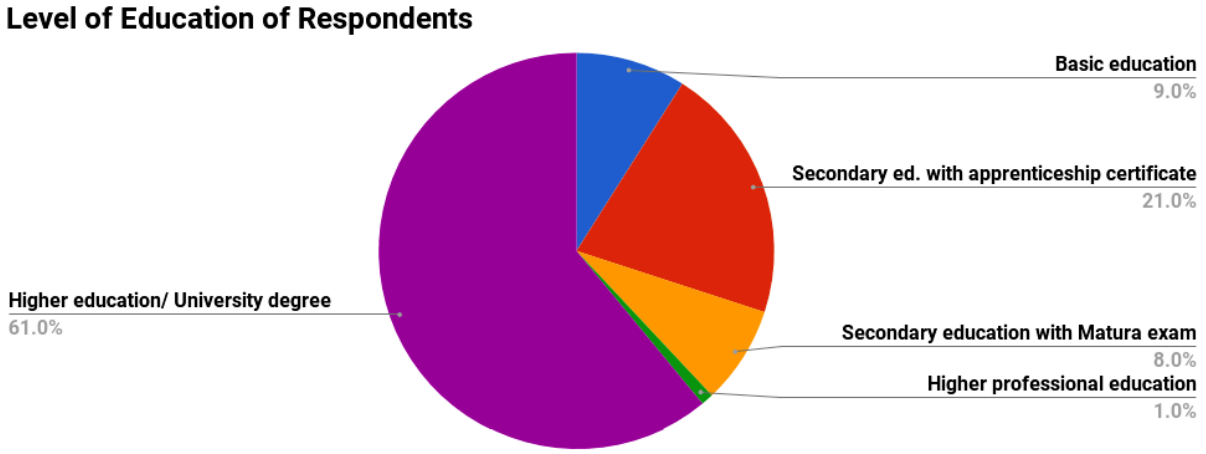

Figure 5.16.: Percentage of Education Level of Respondents, that participated in the Survey in Bavaria

The **Fig. 5.17** depicts that not all of the nine offered Employment status options are represented in the survey. Almost 80% of respondents are employees and the other groups are less represented.

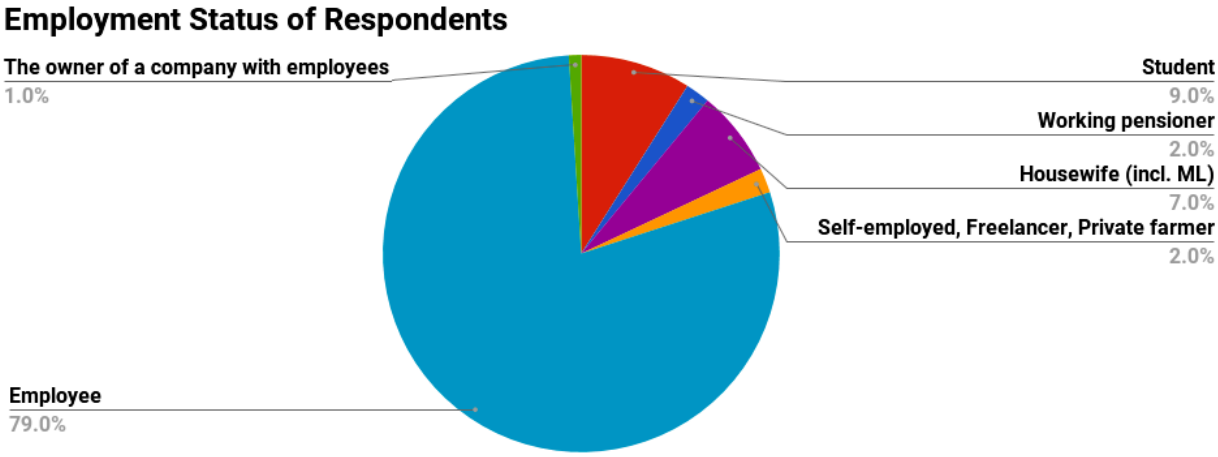

Figure 5.17.: Percentage of the Employment status of Respondents who participated in the survey in Bavaria

Most of the participants of the survey (72%) answered, that they are satisfied or quite satisfied with their monthly income and about 10% is even very satisfied with the monthly income. About 18% find their income dissatisfactory. The overview can be seen in the **Fig. 5.18**.

In the **Tab. 5.1** are the percentages of satisfaction with Monthly Income clearly stated for each employee status.

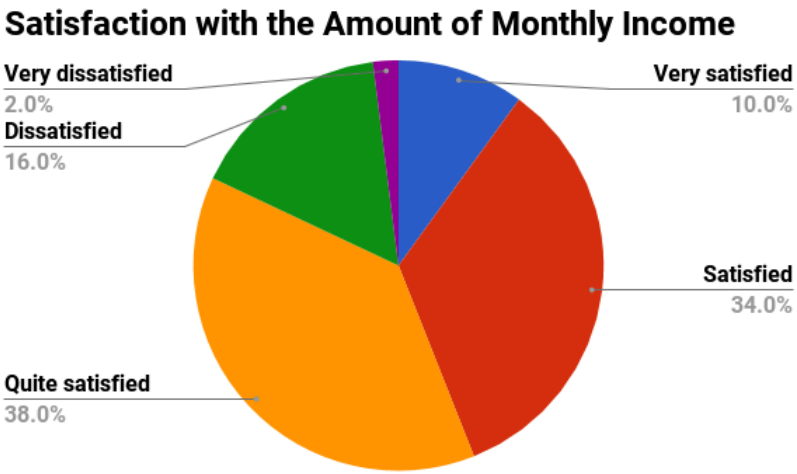

Figure 5.18.: Percentage of the Satisfaction with the Amount of Monthly Income of Respondents from Bavaria

Table 5.2.: Percentage of Satisfaction with the Amount of Monthly Income by the Employment Categories by Bavarian Respondents

	Satisfaction with Monthly Income				
Employment Status	**Very satisfied**	**Satisfied**	**Quite satisfied**	**Dissatisfied**	**Very dissatisfied**
Student	0%	22%	22%	44%	11%
Working pensionier	0%	50%	0%	50%	0%
Housewife	0%	14%	57%	29%	0%
Employee	13%	34%	41%	11%	1%
Self-employed, Freelancer, Private farmer	0%	100%	0%	0%	0%
The owner of a company with employees	0%	0%	100%	0%	0%

In the **Fig. 5.19** is shown in which type of the respondents currently live. About 66% of them live with a partner or in a marriage and 34% live in a household without a partner.

The overview of how big the respondents' households are is shown in the **Fig. 5.20**. The proportions of members living in respondents' households are described in the **Fig. 5.21** and **5.22**.

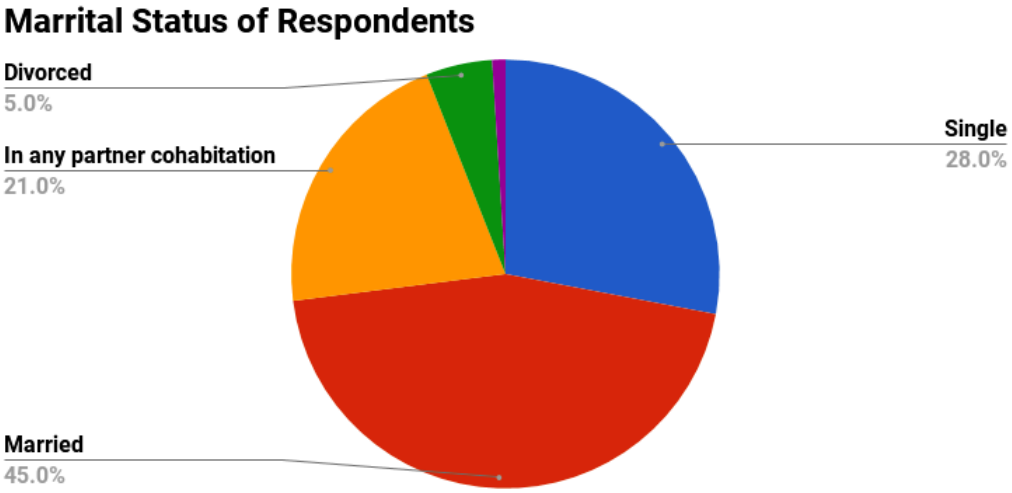

Figure 5.19.: Percentage of the Marital Status of Respondents who participated in the Survey in Bavaria

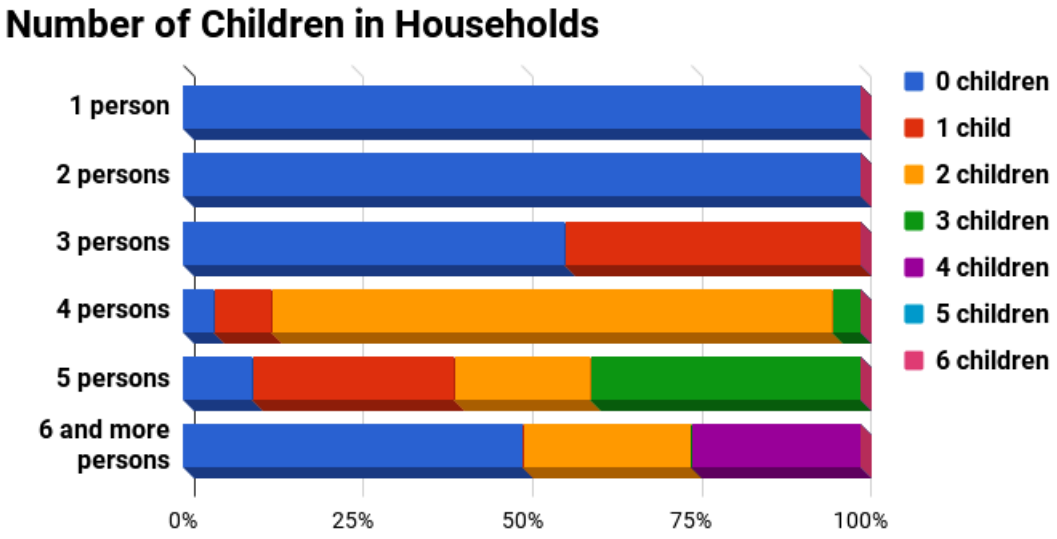

Figure 5.21.: The Number of Children without own Income living in Participants Households in Bavaria

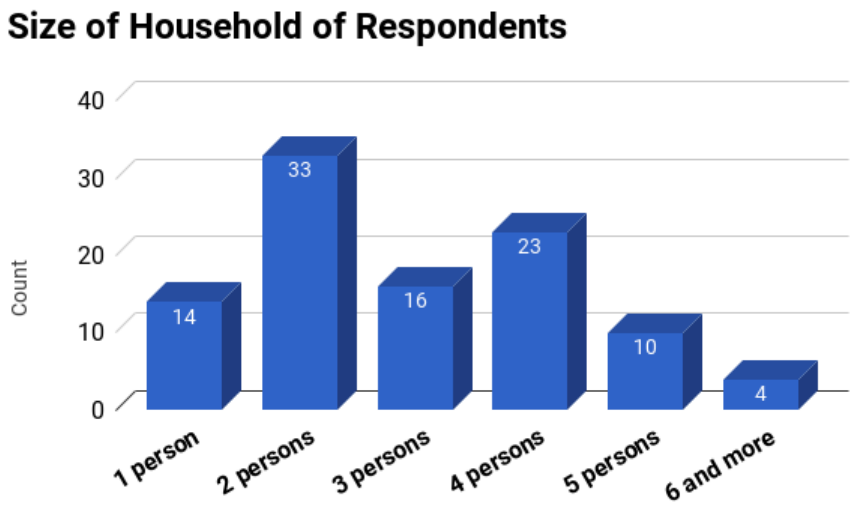

Figure 5.20.: The Number of Respondents from Bavaria living in different Household Sizes

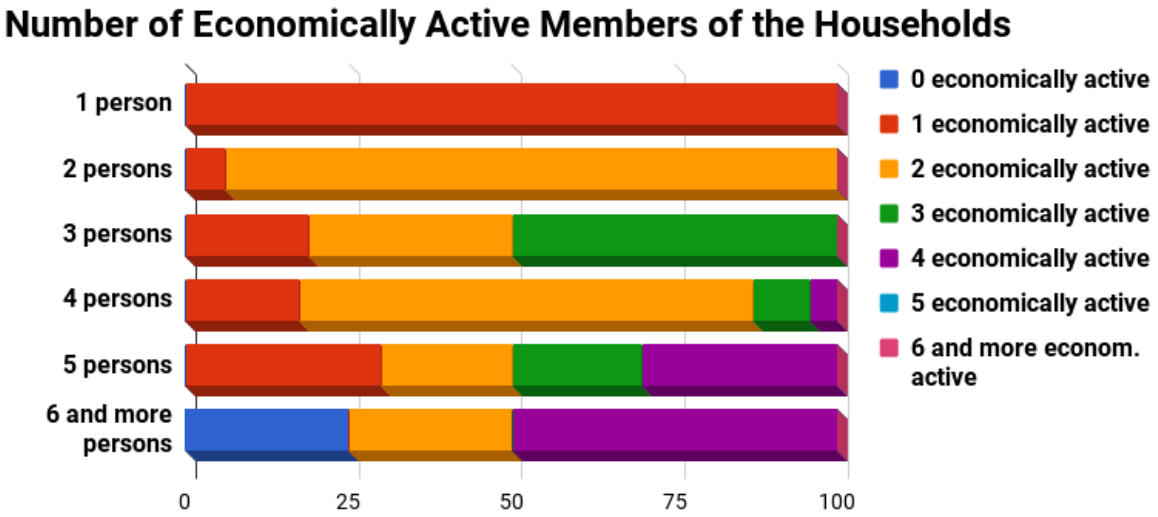

Figure 5.22.: The Number of Economically Active Members living in Participants Households in Bavaria

As mentioned in the previous section, these profile questions will be processed by evaluating the main part of the questionnaire.

5.5. Health and Comfort of the Participants from Bavaria

This section also evaluates satisfaction with temperature, noise level and the amount of fresh air in the place where the respondents fulfilled the questionnaire together with a statement on how healthy the participants feel at the moment. The German version of the questionnaire was fulfilled in exactly 50 % at home, 45% at work, 1% in some restaurant and 4% in another place.

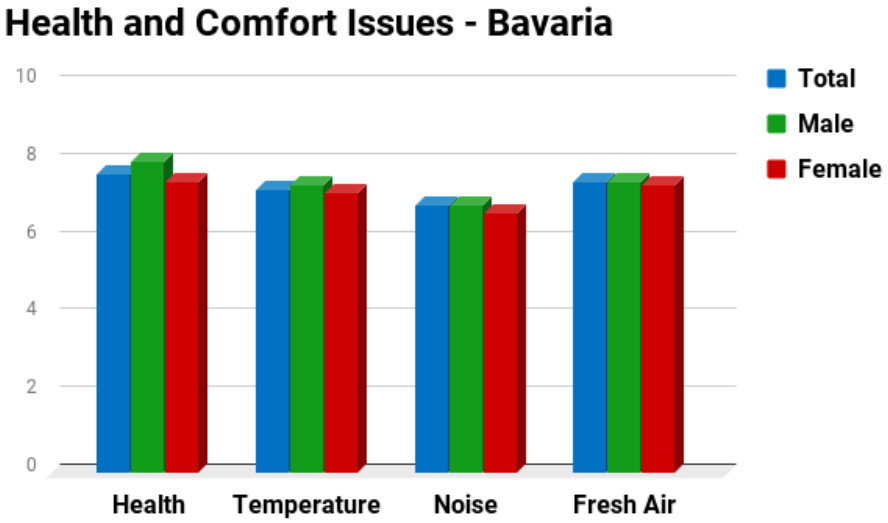

Figure 5.23.: Health and Comfort Issues by Males and Females (Bavaria)

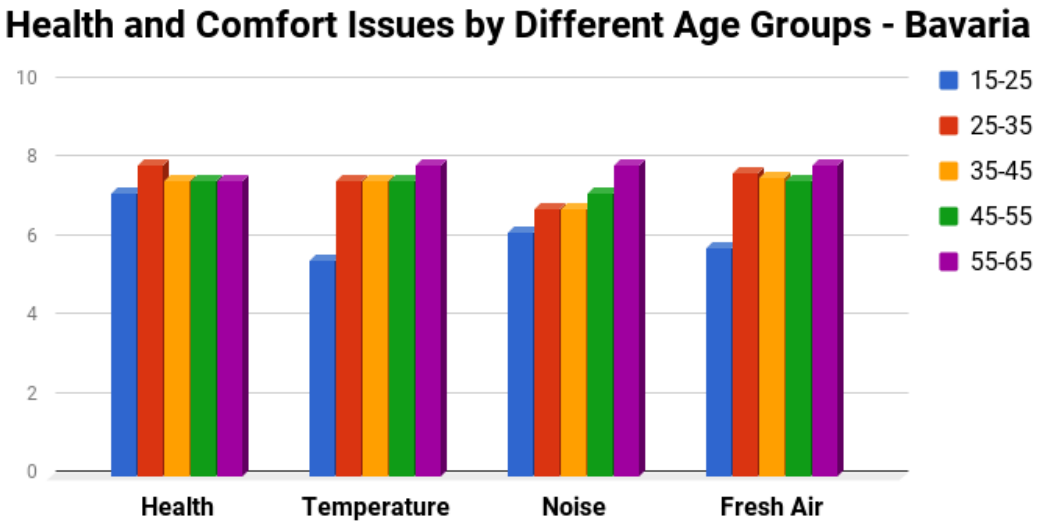

Figure 5.24.: Health and Comfort Issues by Different Age Groups (Bavaria)

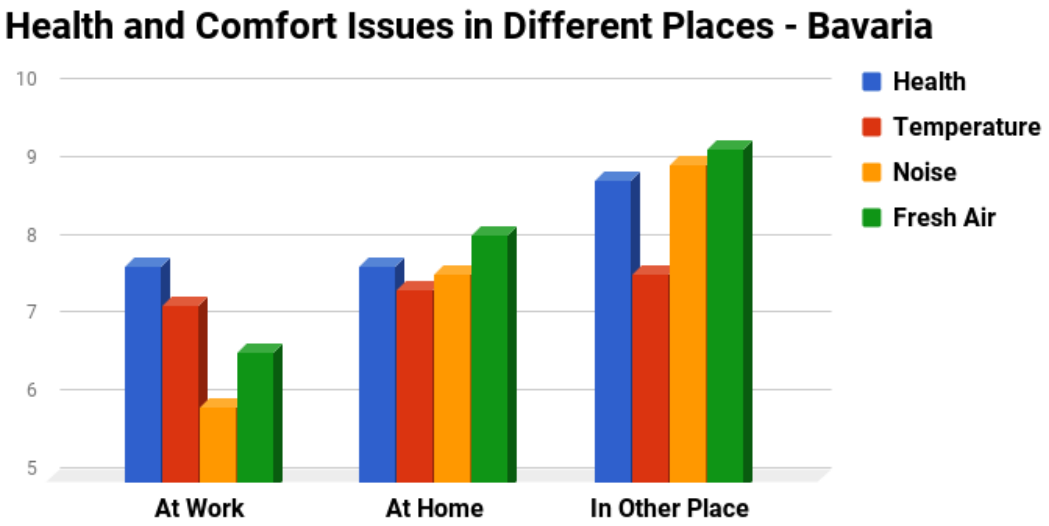

Figure 5.25.: Health and Comfort Issues in Different Places (Bavaria)

The evaluation is shown in the **Figures 5.23, 5.24 and 5.25**.

The women are in the survey less satisfied with than men in all categories and the biggest difference between men and women can be seen by health perception.

The respondents are most dissatisfied with the comfort issues at work.

6. Results

6.1. Survey 1 - Descriptive Statistics

This section elaborates on questions addressed in Part 1 and Part 2. The evaluation concerns the factors influencing the quality of life in the area where the respondents live and the noise from different noise sources and its effects on the people. The percentage distribution of answers to questions Q5 - Q16 collected in the Czech Republic is shown in the figures **Fig. 6.1 - Fig. 6.14**. (The answers to questions Q1, Q2, Q3, and Q4 are already treated in Section 5.2.)

- **Question Q5 How important are for you and your household these factors, which could influence our quality of life?**

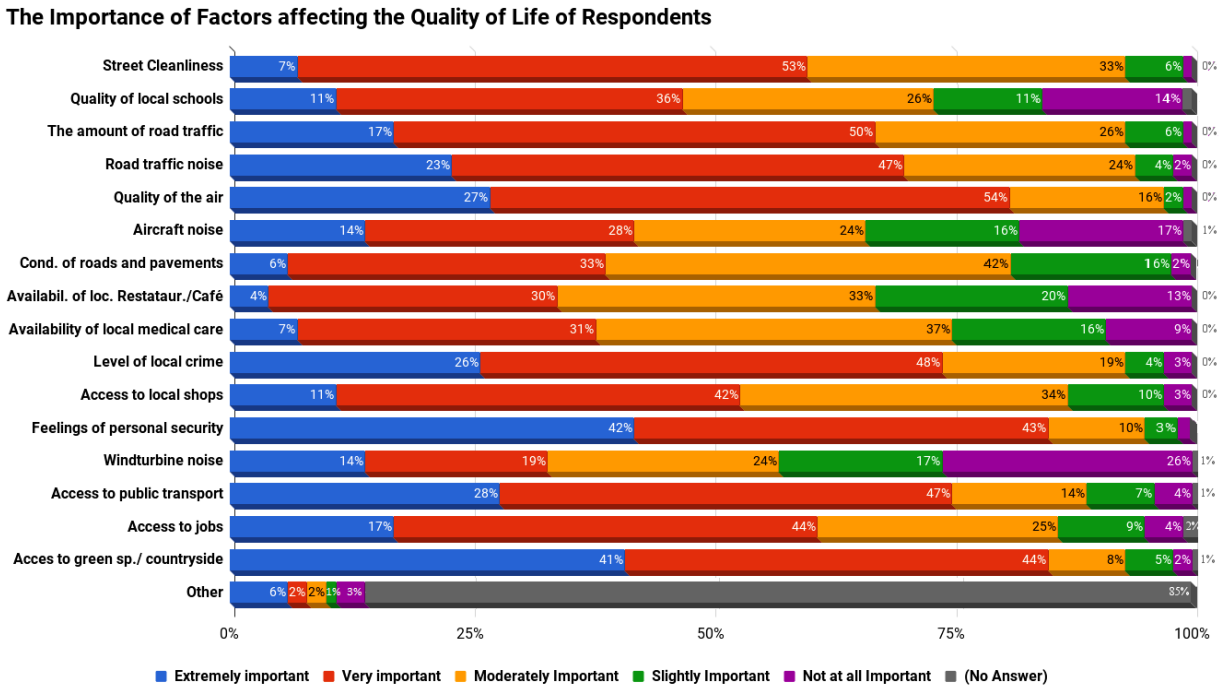

Figure 6.1.: Importance of the Factors, which can Influence Quality of Life, for the Respondents from the Czech Republic and their Households (Q5)

The results are illustrated in **Fig. 6.1** above and show that the three most important factors evaluated as extremely important or very important in the Czech Republic are access to green spaces or countryside (85%), quality of air (85%) and feelings of personal safety (81%). The road traffic noise is extremely important for 23% and very important for 47% of the respondents. Least important for people living in areas without any wind turbine installation is wind turbine noise. On the other hand, for those who have experienced wind power facilities, this quality of life factor is extremely important or very important.

The mean scores of the importance of road traffic noise, aircraft noise, and wind turbine noise sorted by Czech regions are listed in the **Tab. 6.1**. One means extremely important and five means not at all important.

Table 6.1.: Importance of the Selected Environmental Noise Sources

	Mean Scores of Importance		
Regions	**Road Traffic Noise**	**Aircraft Noise**	**Wind Turbine Noise**
Carlsbad Region	3.0	4.0	4.2
Central Bohemian Region	2.1	2.7	3.2
Hradec Kralove Region	1.6	2.0	2.4
Liberec Region	1.5	3.0	3.5
Moravian-Silesian Region	1.4	2.0	1.4
Pardubice Region	2.0	3.2	3.8
Olomouc Region	2.5	3.5	3.8
Pilsen Region	2.1	2.7	3.0
Prague - City Region	2.4	3.2	3.7
Southbohemian Region	2.4	3.3	3.8
Southmoravian Region	1.9	2.7	3.0
Usti Region	2.1	3.9	2.5
Vysocina Region	2.6	3.7	3.4
Zlin Region	1.4	3.2	3.8

- **Question Q6 How satisfied are you with the below-listed factors in your local area?**

With all the factors affecting the quality of life was at least 30% of the respondents very satisfied or satisfied. Most satisfied are people with access to green spaces or countryside (85%), and feelings of personal safety (85%). Respondents' answers vary depending on the municipality

where they come from.

The respondents from Prague and Pilsen are generally less satisfied with the factors, except for the availability of local shops and jobs in both cities, and availability of public transport in Prague.

In Pilsen, there are about 31% of respondents dissatisfied or even very dissatisfied with the amount of road traffic. In Prague, only 17% and totally 20% of dissatisfied respondents are present. Road traffic noise is very dissatisfactory or dissatisfactory for 12% of respondents, for 16% of respondents from Pilsen and 13% of respondents living in Prague. About 17% of total amount of respondents is neutral to the road traffic noise, Almost 30 % of respondents did not complete the answer concerning road traffic noise.

16% of respondents complain about the quality of air, and even 21% of respondents from Prague. With aircraft noise and wind turbine noise were people mostly satisfied, except for respondents living in areas where this source of noise is present.

Table 6.2.: Satisfaction with the Selected Environmental Noise Sources

	Mean Scores of Satisfaction		
Regions	**Road Traffic Noise**	**Aircraft Noise**	**Wind Turbine Noise**
Carlsbad Region	3.0	2.0	1.8
Central Bohemian Region	2.4	1.5	1.6
Hradec Kralove Region	2.8	2.2	2.0
Liberec Region	1.5	1.0	1.0
Moravian-Silesian Region	1.8	1.0	1.6
Pardubice Region	2.2	1.6	1.6
Olomouc Region	2.5	1.0	1.0
Pilsen Region	2.5	1.8	1.6
Prague - City Region	2.4	1.8	1.5
Southbohemian Region	2.0	1.4	1.7
Southmoravian Region	2.2	2.0	1.4
Usti Region	3.0	1.6	2.9
Vysocina Region	2.7	1.4	1.3
Zlin Region	2.1	1.3	2.0

The **Tab. 6.2** gives an overview of average satisfaction with the road traffic noise, aircraft noise, and wind turbine noise across Czech regions. One is very satisfied and five is very dissatisfied.

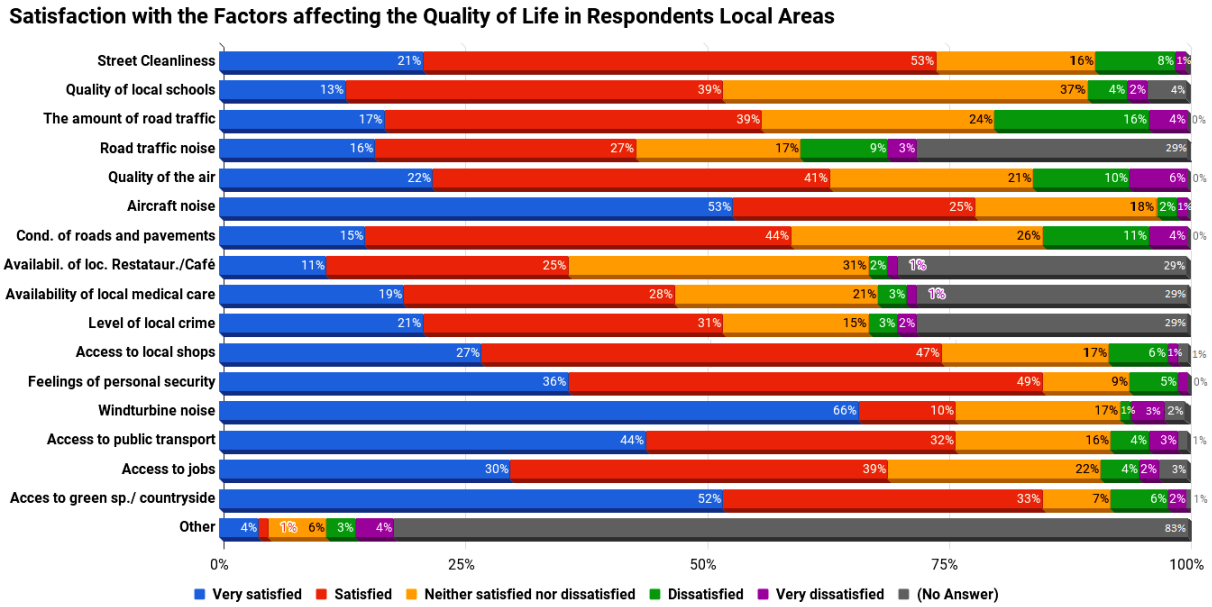

Figure 6.2.: Satisfaction with Quality of Life Factors in Respondents' Local Areas in the Czech Republic (Q6)

- **Question Q7 How often do you notice noise from the following sources at home?**

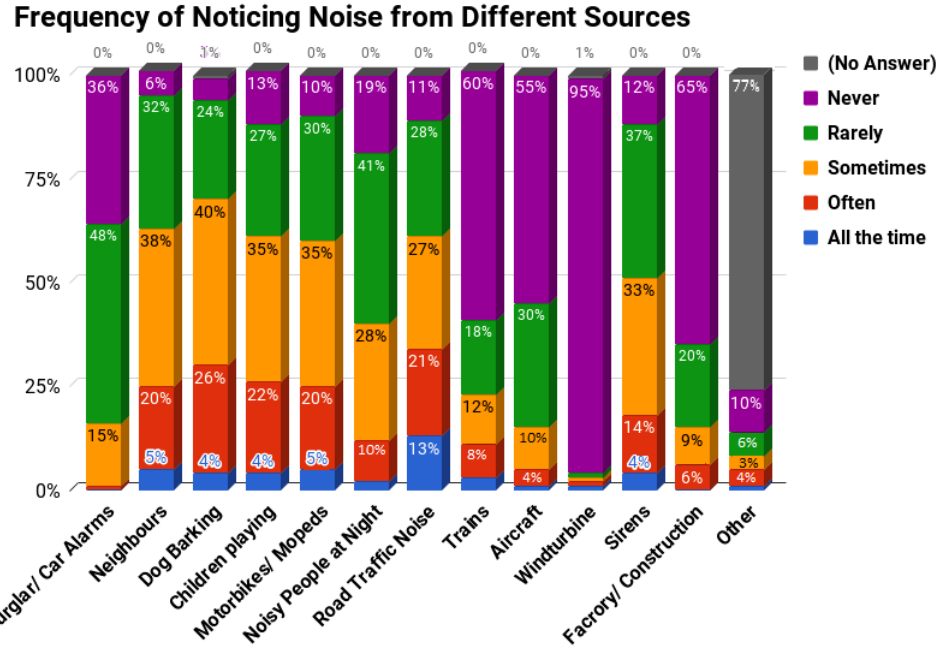

Figure 6.3.: How Often do the Respondents Notice these Noise Sources at Home (Q7)

Most people encounter road traffic noise. This noise source is noticed at least "sometimes" by 61% of all respondents, and in Pilsen even by 68% of respondents. The road traffic noise is noticed "all the time" or "often" by 34% respondents, in Pilsen by 40% of the respondents. In Prague, road traffic noise is encountered among other noise sources less often than in the whole batch.

The respondents frequently perceive also dog barking, children playing, or noisy neighbors. Mopeds or motorbikes encounter the participants of the survey more often.

Noisy people at night are noticed by 40% of respondents at least sometimes, in Pilsen even by 54% of respondents.

Noise caused by aircraft or trains is less perceived. Almost nobody notices the wind turbine noise except the respondents living in areas where this source of noise is present, such as from the Usti Region. The wind turbine is also considered by 67% of respondents as not at all noisy.

- **Question Q8 How noisy do you consider these noise sources?**

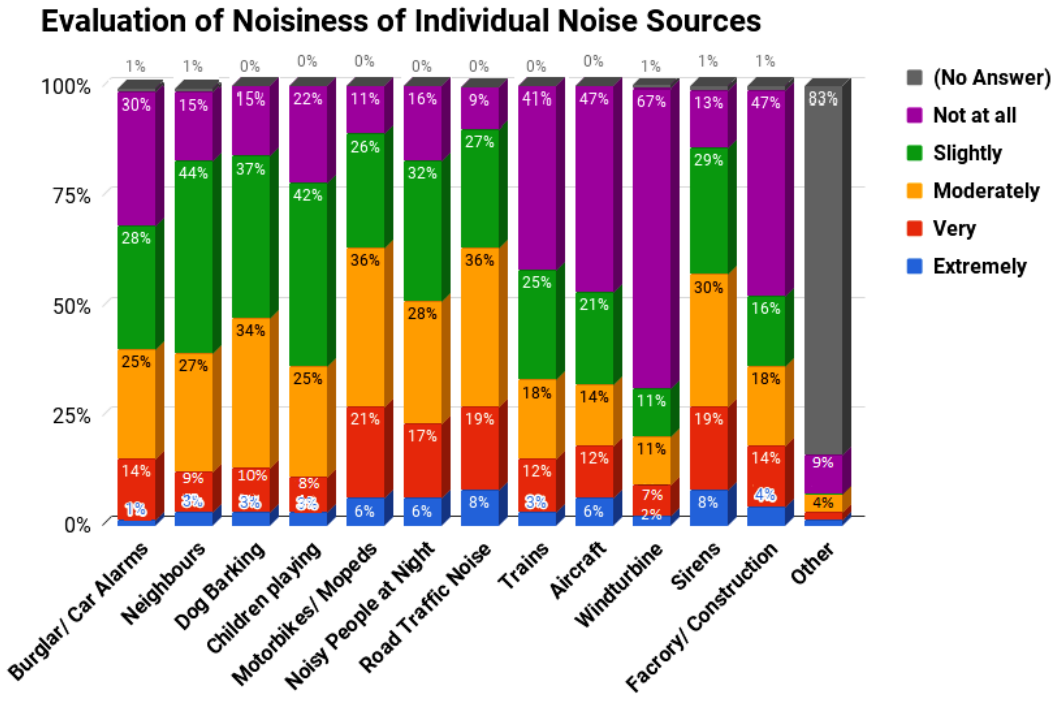

Figure 6.4.: How Noisy do the Respondents Consider the Noise Sources (Q8)

As depicted in **Fig. 6.4,** 27% of people consider the road traffic noise as extremely or very noisy, and 36% as moderately noisy. In Prague and also in Pilsen, people consider the road

traffic noise slightly less noisy than in total. In Prague, the road traffic noise was evaluated as extremely or very noisy by 29% of participants and moderately noisy by 30%, and in Pilsen by 22% extremely or very noisy, and by 30% moderately noisy.

Dog barking, children playing, and noisy neighbors were evaluated as slightly or not at all noisy by more than 50% of respondents. Mopeds, motorbikes, and sirens are considered as noisier. Both of these two noise sources were described as extremely or very noisy by 27% of respondents.

Rowdy people at night were evaluated as extremely or very noisy by 23% of the respondents, and 28% consider this noise source moderately noisy.

Airplanes and trains are assessed as not at all or slightly noisy by almost 70% of respondents. In Prague, airplanes are considered as extremely or very noisy by 22% of respondents, moderately noisy by 11%. Compared to all noise sources, aircraft are rated as slightly noisy or not at all noisy by a much smaller proportion of respondents (46%). Also, trains were evaluated as slightly or not at all noisy by fewer participants from Prague (48%) than in total. In Pilsen, airplanes and trains are also considered as noisier than in total. However, the difference is not as significant as in the case of Prague.

- **Question Q9 How noisy do you consider the place where you live?**

More than half of all respondents find the place where they live as not very noisy. Nine percent of respondents consider their place of living very or extremely noisy, in Pilsen and Prague 11% and 13%, respectively. 30% of all respondents from the Czech Republic, 39% of respondents from Pilsen and 28% from Prague find it moderately noisy.

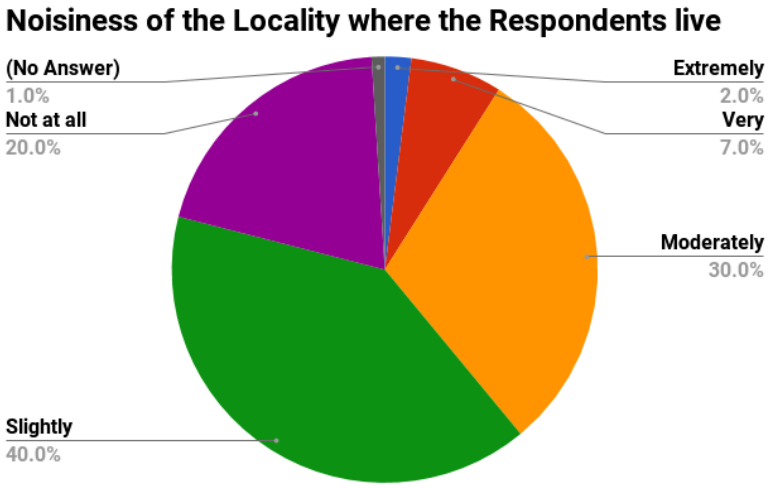

Figure 6.5.: How Noisy do the Respondents Consider the Locality where they live (Q9)

- **Question Q10 How was the noise level in last 12 months?**

87% of all Czech respondents, thereof about 85% of respondents from Pilsen and 89% Prague state that the noise level is unchanged within the last 12 months. The noise level increased for 11% of all respondents from the Czech Republic as well as from Pilsen. Almost nowhere did the noise level within last 12 months decrease.

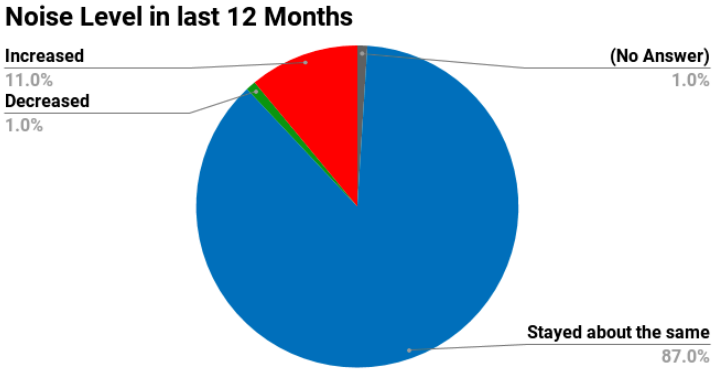

Figure 6.6.: How did the Noise Level in the Areas, where the Respondents Live, Change within the Last 12 Months (Q10)

- **Question Q11 Do you consider yourself more or less sensitive to noise as other people?**

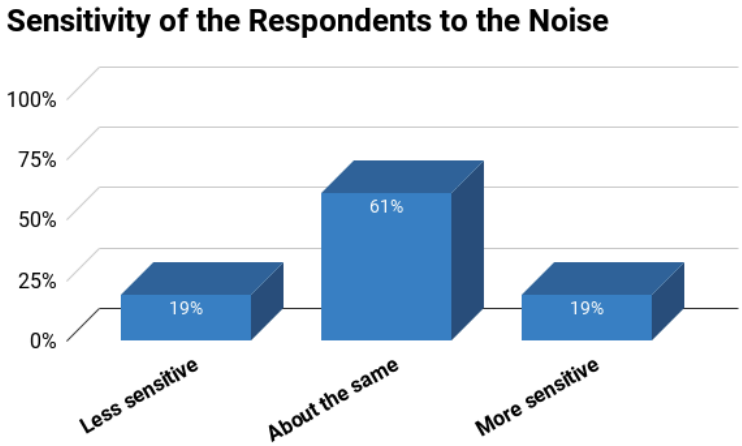

Figure 6.7.: How Sensitive are the Respondents to the Noise (Q11)

More than half of all survey participants assessed themselves being as equally sensitive to noise as the others. More and less sensitive form two same large groups. About 33% of the respondents

from Prague believe to be less sensitive to the noise than the rest of the population. In Pilsen, it is only 13% of the survey participants. In Prague, 13%, and in Pilsen is 16% of the respondents are more sensitive.

- **Question Q12 Considering the last 12 month: How did the noise from below-listed sources annoy you when you were at home?**

Responses to this question correspond with the answers to the question Q7. The most annoying in last 12 months were for respondents: road traffic noise, noisy people at night, motorbikes and mopeds.

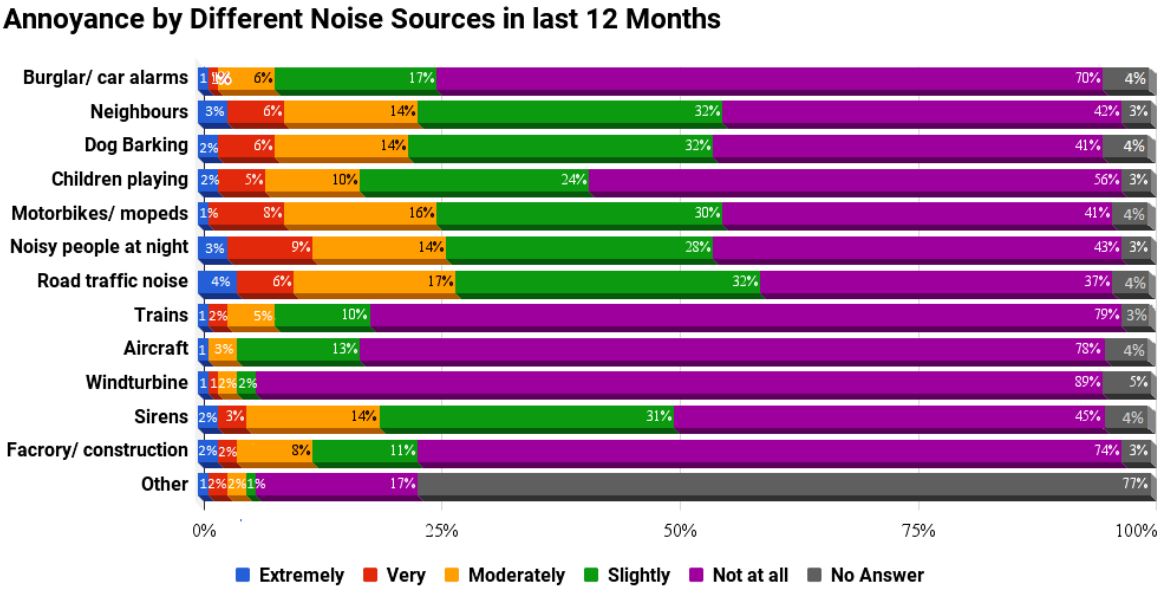

Figure 6.8.: How much Annoying was the Noise from the Noise Sources Named above for the Respondents (Q12)

- **Question Q13 Totally, how annoying is noise in the place where you live?**

At least moderately annoying is the environmental noise for 27% of all respondents from the Czech Republic, 24% from Prague, and 33% from Pilsen.

For 33% of all respondents, 43% respondents from Prague, and only 21% respondents from Pilsen, is the noise in their neighborhoods not annoying. In this case, there is quite a big difference between Prague and Pilsen.

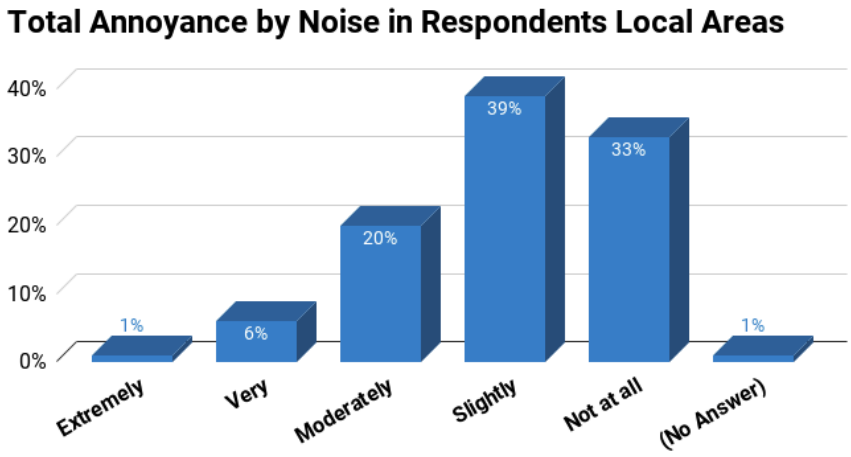

Figure 6.9.: How much Disturbing is the Noise Generally in Place, where the Respondents Live (Q13)

- **Question Q14 When are you usually at home during the week?**

Further important information for the survey results contains a question that focuses on the time that a participant spends at home. The overview of this question can be seen in the **Fig. 6.10**. As expected, most respondents stay at home at night and early in the morning. Responses concerning daytime or weekends are more varied.

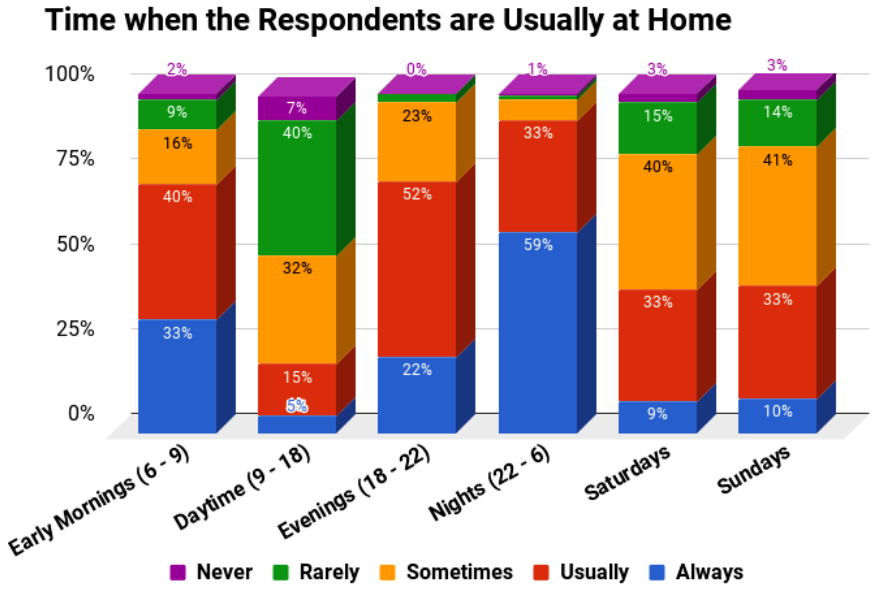

Figure 6.10.: Day and Night Time which the Participants Usually Spent at Home (Q14)

- **Question Q15 Do you notice if noise from different sources disturbs your activities when you are at home?** (road traffic noise, aircraft noise, wind turbine noise and other noise)

The highest proportion of respondents complained about noise caused by road traffic. This noise disturbs 32% of the respondents from their social life or relaxing in the garden, 29% from sleeping, 27% from reading, writing or concentration, and also from other activities. In Prague, the road traffic noise bothers among other activities by 28% of respondents their social life or relaxing in the garden, by 28% their sleeping, and by 26% disturbs reading, writing or concentration. By road traffic noise are the respondents from Pilsen disturbed in 31% of cases by sleeping, in 30% of cases by reading, writing or concentration, and in 22% of cases is disturbed respondents' social life and relaxing in the garden.

Aircraft noise or wind turbine noise is disturbing for people living in such affected areas, but on average both of them do not reach so high numbers as road traffic noise.

The proportion of all "yes" answers to this question is captured in a three-dimensional histogram disclosed in **Fig. 6.11**.

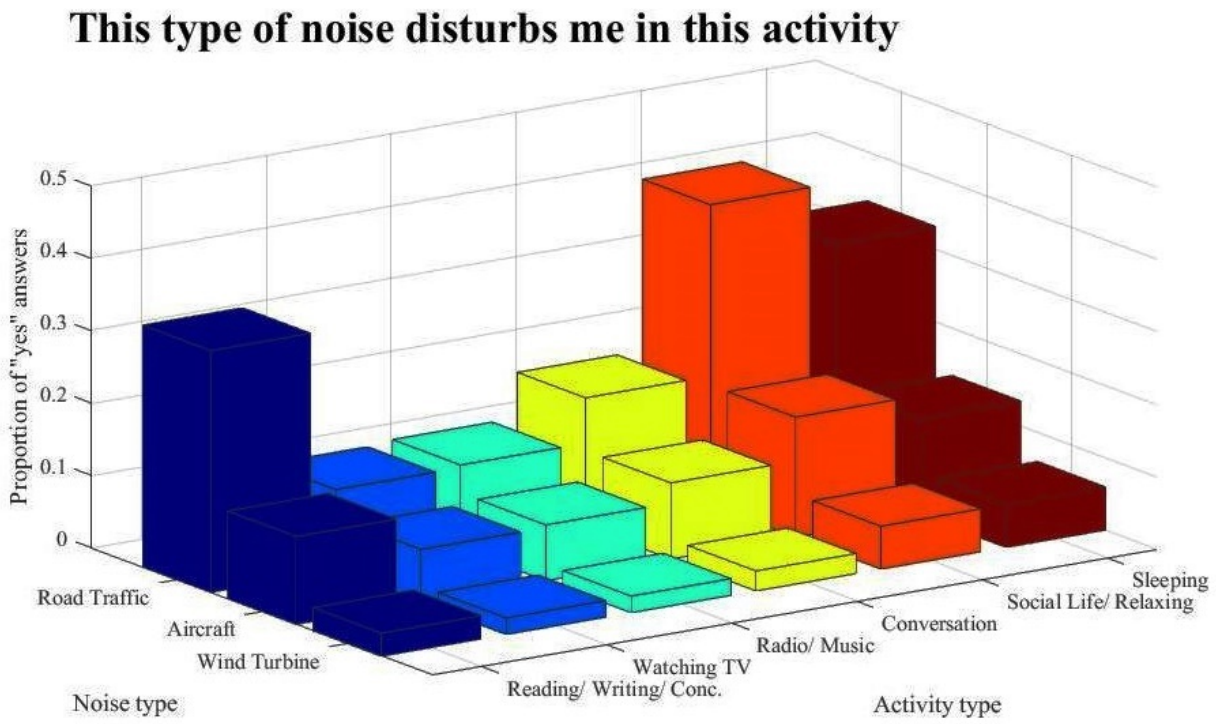

Figure 6.11.: Disturbance of Respondents' Activities Dependent on the Environmental Noise Source (Q15)

Other noise

As other noise sources were often named trains, respondents' neighbors, and building construction. Mentioned as annoying was also: garden equipment, playing children, public concerts, and rowdy people at night.

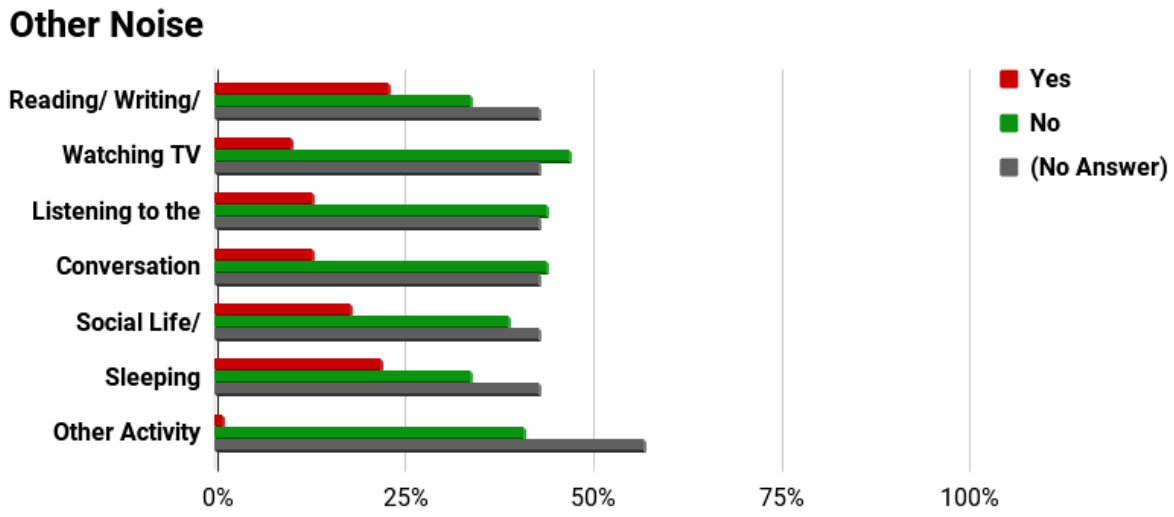

Figure 6.12.: Disturbance of Respondents' Activities by Other Noise (Q15d)

- **Question Q16 This noise source always:** (road traffic noise, aircraft noise, wind turbine noise and other noise)

The three-dimensional graph in **Fig. 6.13** points out that the road traffic noise often causes the participants of the survey to close their windows. This happens due to excessive road traffic noise, 36% of all respondents, 39% respondents from Pilsen and in Prague even 46% respondents. This noise source is also capable of wake up 18% of all respondents, 13% of respondents from Prague, and 24% of respondents from Pilsen. 11% of all respondents, 9% of respondents from Pilsen, and 4% of respondents from Prague report, that the road traffic noise causes their house to shake or vibrate. 9% of respondents from Pilsen also reported that road traffic noise can startle them up.

The same actions and, in addition, startling causes aircraft noise too, but it is noticed by a much smaller number of respondents than road traffic noise.

The answers to the sub-question devoted to the wind turbine noise gave only half of the respondents. Therefore the question is difficult to evaluate.

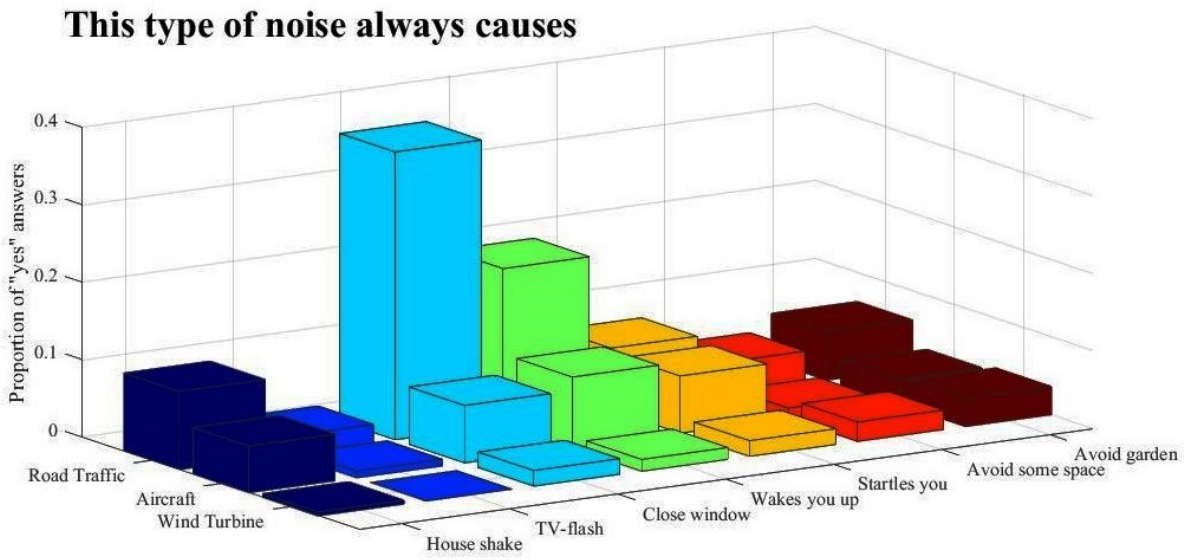

Figure 6.13.: Respondents' Discomfort Caused by Environmental Noise (Q16)

Other noise

Other noises are noticed in Pilsen a little bit more than in Prague or in the whole Czech Republic.

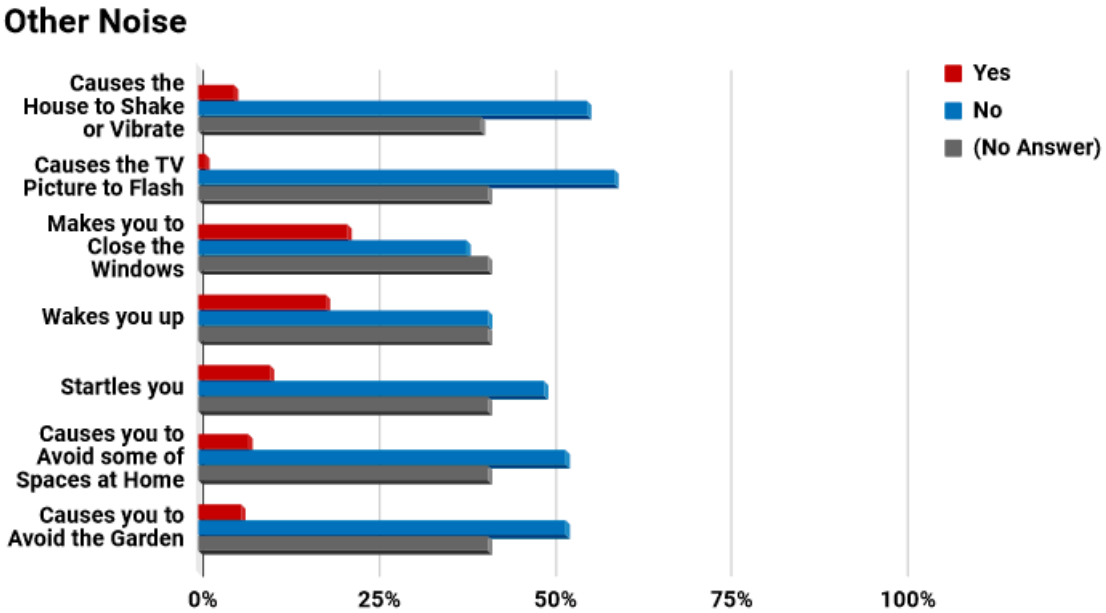

Figure 6.14.: Respondents' Discomfort Caused by Other Noise (Q16d)

6.2. Survey 2 - Descriptive Statistics

This section shows the evaluation of questions from Part 1 and Part 2 concerning factors influencing the quality of life in the area where the respondents live and the noise from different noise sources and its effects on people. (The answers to questions Q1, Q2, Q3, and Q4 are already treated in Section 5.4)

- **Question 5 How important are for you and your household these factors, which could influence our quality of life?**

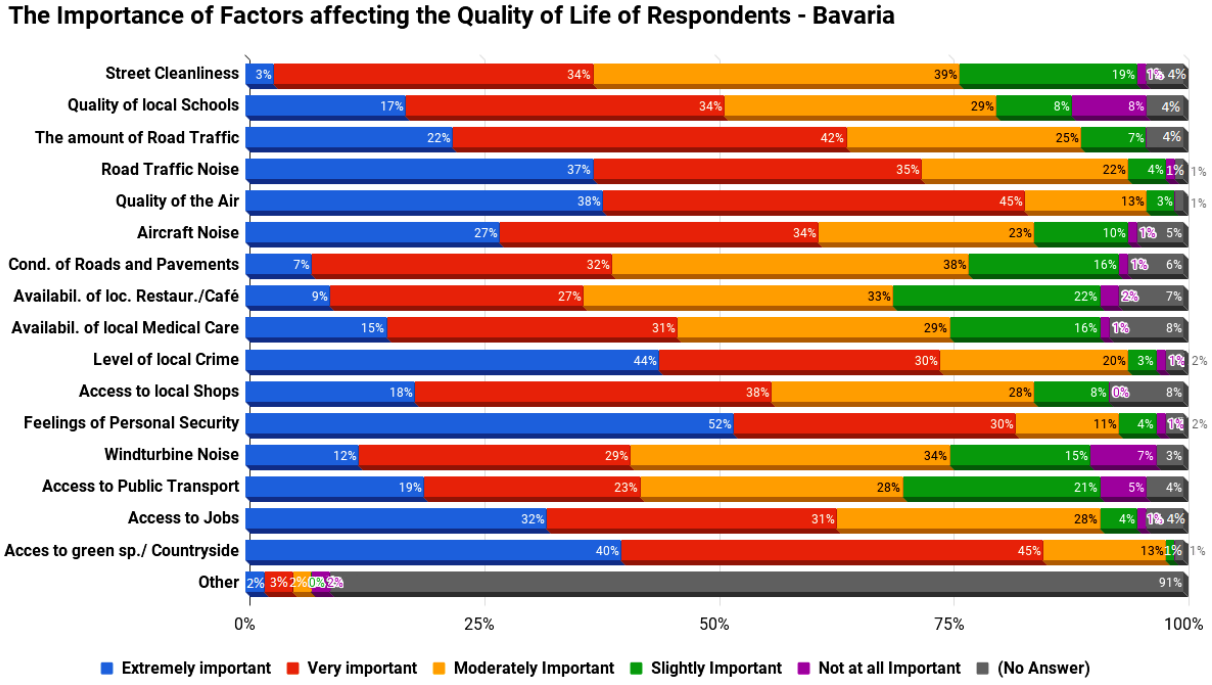

Figure 6.15.: Importance of the Factors, which can Influence Quality of Life, for the Respondents from Bavaria and their Households (Q5)

The proportions giving each response are depicted in **Fig. 6.15.** The three most important factors evaluated as extremely important or very important in Bavaria are access to green spaces or countryside (85% of respondents), quality of air (83%), and feelings of personal safety (82%). The road traffic noise is extremely important for 37% of the participants and very important for 35 % of them. The level of local crime, the amount of road traffic noise, access to a job, and aircraft noise are also extremely or very important for more than 60 % of the respondents.

- **Question 6 How satisfied are you with the below-listed factors in your local area?**

About 55% of the Bavarian respondents are very satisfied or satisfied with all of the factors affecting the quality of life. The survey participants are most satisfied with street cleanliness - 87% of them are very satisfied or satisfied, access to green spaces or countryside (86%), and condition of roads and pavements (83%). More than 80% of respondents are also very satisfied or satisfied with aircraft noise, wind turbine noise, and feelings of personal safety. The survey participants were least satisfied with the access to public transport.

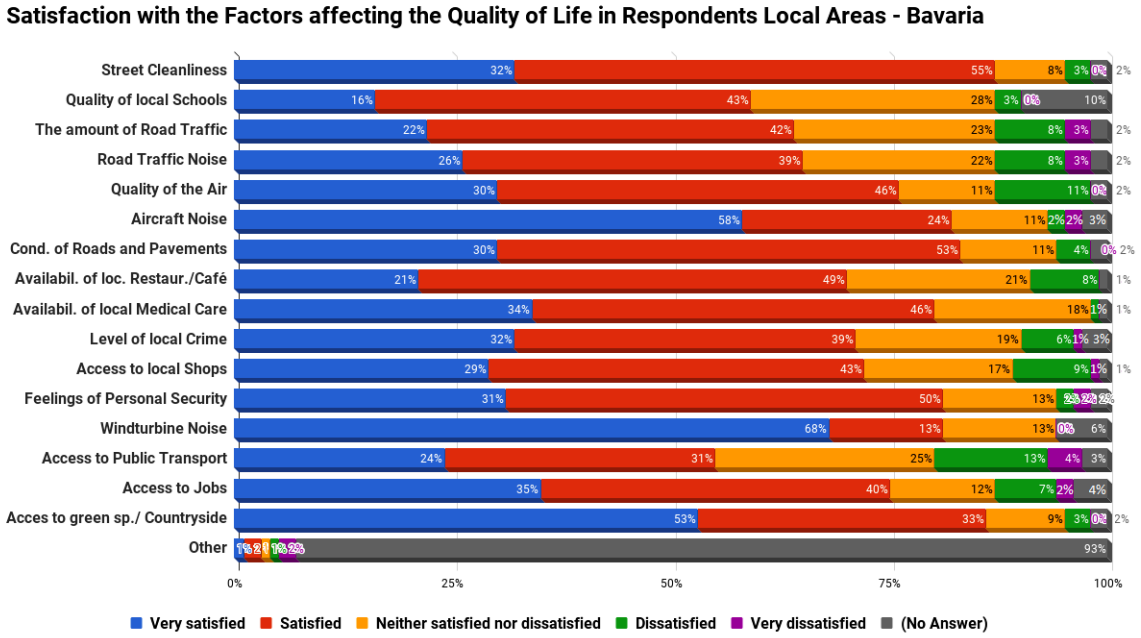

Figure 6.16.: Satisfaction with Quality of Life Factors in Respondents' Local Areas in Bavaria (Q6)

- **Question 7 How often do you notice noise from the following sources at home?**

As the most frequently noticed environmental noise were by Bavarian respondents described the road traffic noise. Approximately 61% of the respondents encounter the road traffic noise at least sometimes. It is considered as extremely or very noisy by 24% of the respondents and by 35% it is considered moderately noisy.

At least sometimes perceived more than 50 % of respondents also their noisy neighbors, mopeds or motorbikes, and children playing. Motorbikes and mopeds were evaluated even noisier than the road traffic. 32% of the respondents think, that motorbikes and mopeds are extremely or

very noisy. Playing children and neighbors are considered much less loud, More than 50% of respondents evaluated them as slightly or not at all noisy, and only 9% of respondents evaluated them as extremely or very noisy. The least noticed are wind turbines, burglar or car alarms, and a factory or a construction. More than a half of the survey participants evaluated these noise sources as slightly or even not at all noisy.

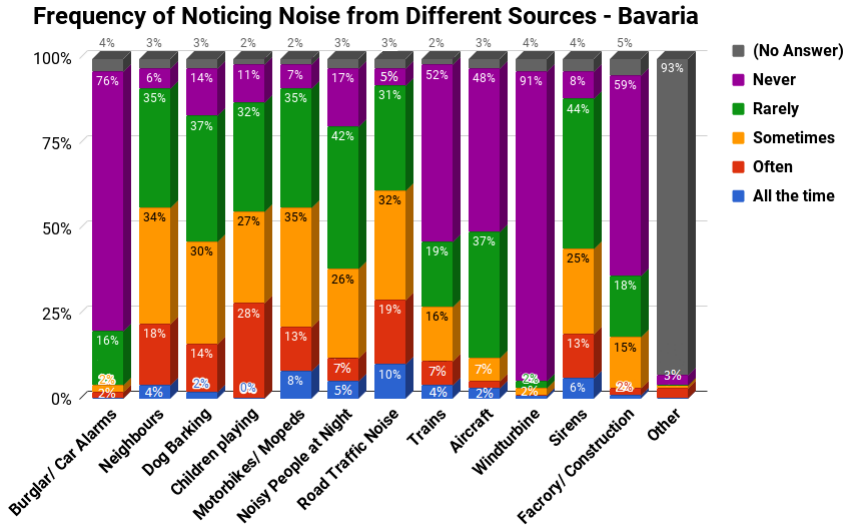

Figure 6.17.: How often do the Respondents Notice these Noise Sources at Home (Q7)

- **Question 8 How noisy do you consider these noise sources?**

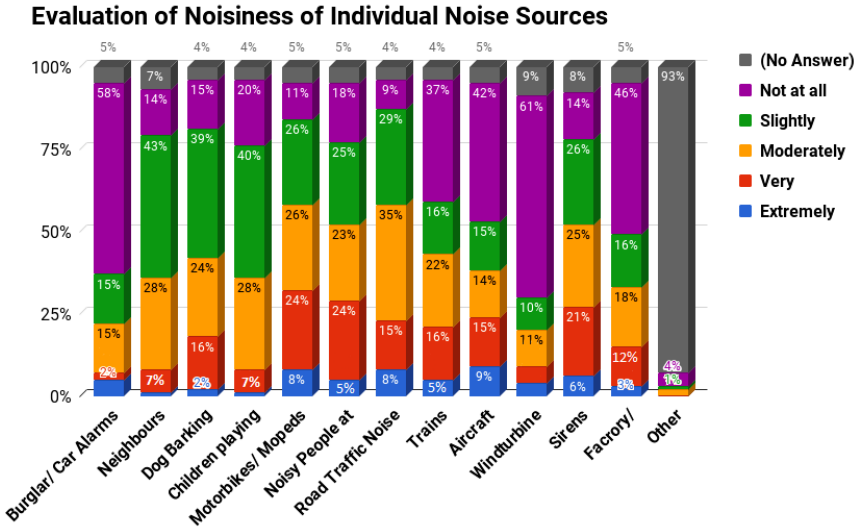

Figure 6.18.: How Noisy do the Respondents Consider the Noise Sources (Q8)

Especially by sirens, noisy people at night, and motorbikes or mopeds differ the respondents' answers to the question Q8 a lot. In other words, almost all the options are represented evenly.

- **Question 9 How noisy do you consider the place where you live?**

About 65% of the respondents think that their habitat is not too noisy. Approximately 10% of respondents consider their place of living very noisy, and 17% consider it moderately noisy.

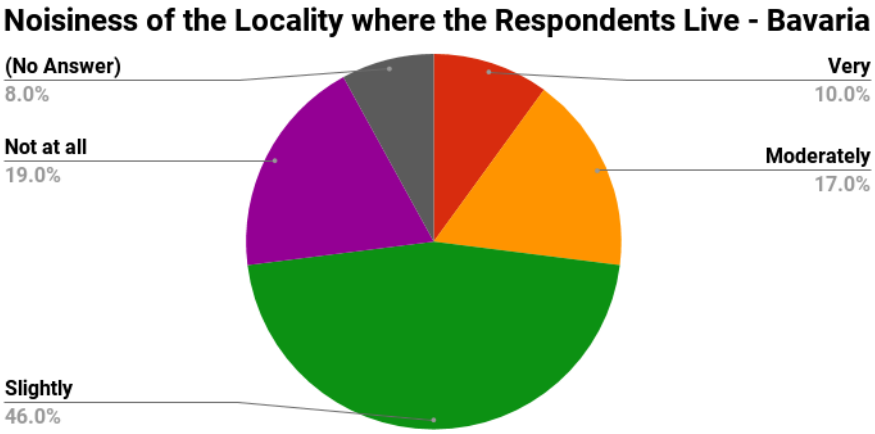

Figure 6.19.: How Noisy do the Respondents Consider the Locality where they live (Q9)

- **Question 10 How was the noise level within the last 12 months?**

The noise level stayed within the last 12 months about the same by 81% of Bavarian respondents, and by 15% of the respondents, the noise level increased. By none of the respondents did the noise level within the last 12 months decrease.

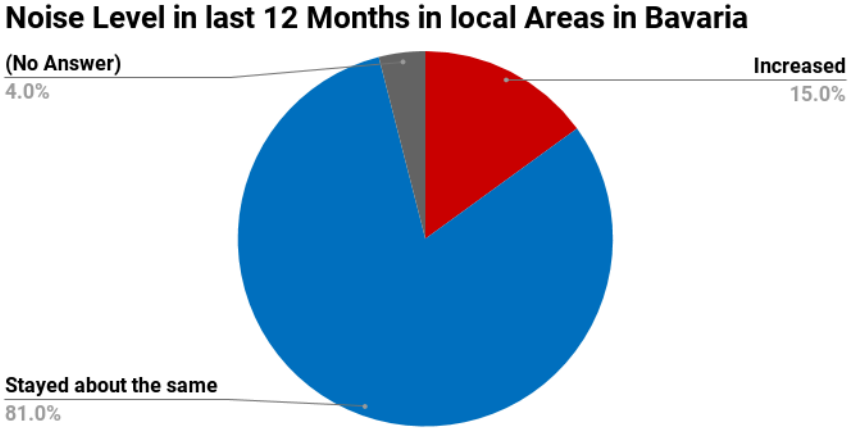

Figure 6.20.: How did the Noise Level in the Areas, where the Respondents live, change in last 12 Months (Q10)

- **Question 11 Do you consider yourself more or less sensitive to noise as other people?**

More than half of the survey participants assessed themselves being as equally sensitive to noise as the others. Less sensitive to noise consider themselves 26% of the respondents, and more sensitive about 19% of the respondents.

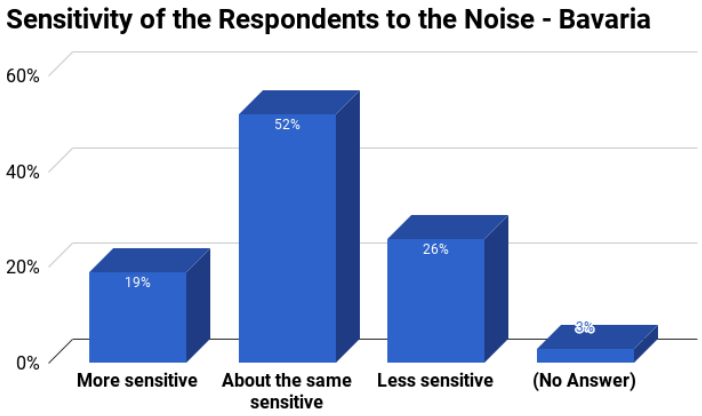

Figure 6.21.: How Sensitive are the Respondents to the Noise (Q11)

- **Question Q12 Considering the last 12 month: How did the noise from the below-listed sources annoy you when you were at home?**

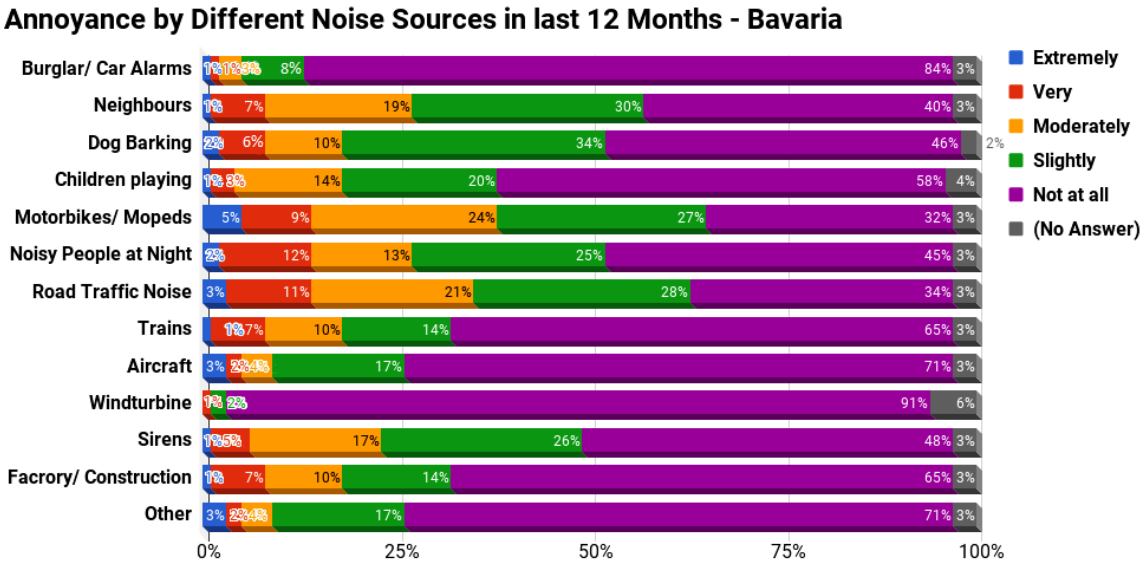

Figure 6.22.: How much Annoying was the Noise from the Noise Sources named above for the Respondents (Q12)

Answering the question Q12 corresponds with the answers to the question Q7 as well as in the case of the Czech Republic. The most annoying noise sources within the last 12 months were: road traffic noise, noisy people at night, motorbikes, and mopeds. Least of all sources of noise annoyed respondents wind turbines, and the burglar or car alarms. Factory and construction mentioned by the question Q7 were estimated by nearly 80% of survey participants as slightly or even not at all annoying.

- **Question 13 Totally, how annoying is noise in the place where you live?**

At least moderately annoying is the environmental noise in the neighborhood of 16% of the Bavarian respondents. Most of the respondents (81%) evaluated the noise at their place slightly or not at all annoying.

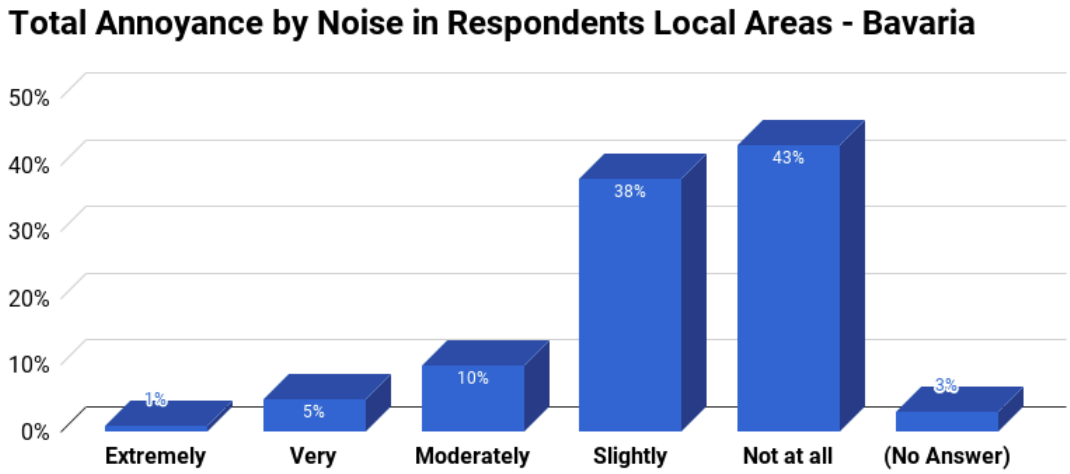

Figure 6.23.: How Disturbing is the Noise generally in Place, where the Respondents Live (Q13)

- **Question 14 When are you usually at home during the week?**

Further important information for the survey results contains a question that focuses on the time that a participant spends at home. The time that a participant usually spent at home is shown in the Figure 6.24.

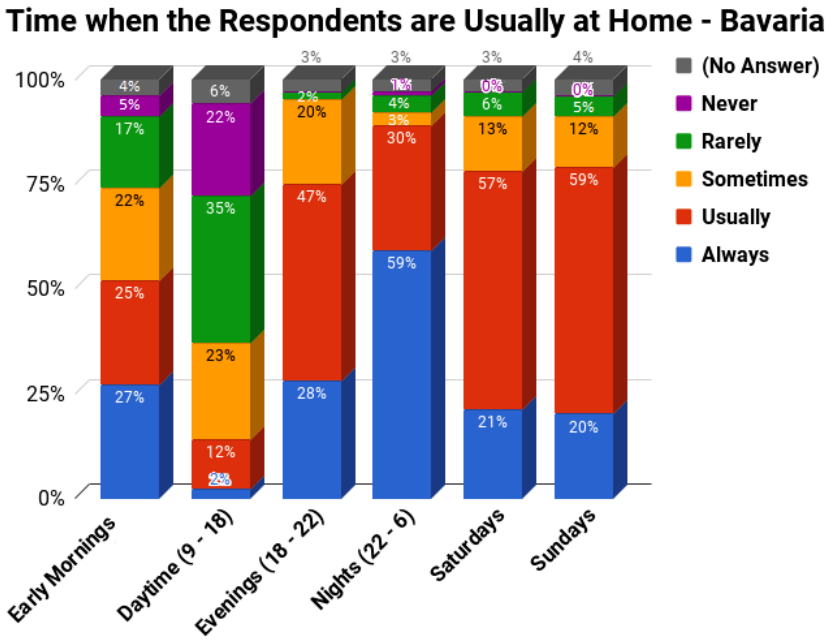

Figure 6.24.: Day and Night Time which the Bavarian Participants usually spent at Home (Q14)

- **Question Q15 Do you notice whether noise from different sources disturbs your activities when you are at home?** (road traffic noise, aircraft noise, wind turbine noise and other noise)

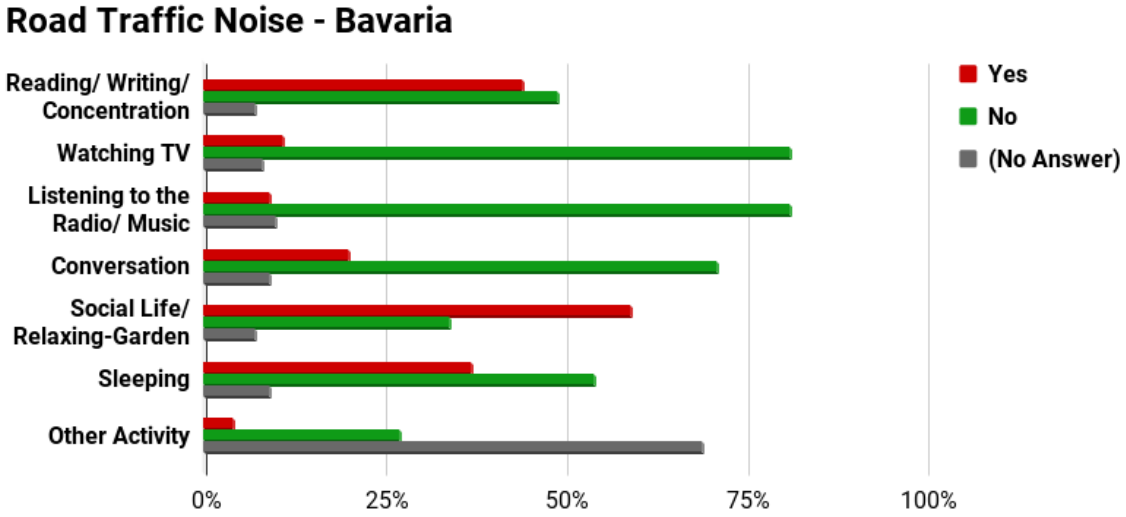

Figure 6.25.: Which Respondents' Activities are Annoyed by Road Traffic Noise (Q15a)

The highest proportion of respondents complained about the noise caused by road traffic. This noise disturbs 59% of the respondents from their social life or relaxing in the garden, 44% from reading, writing or concentration, 37% from sleeping, and 20% of the conversation, and also from other activities.

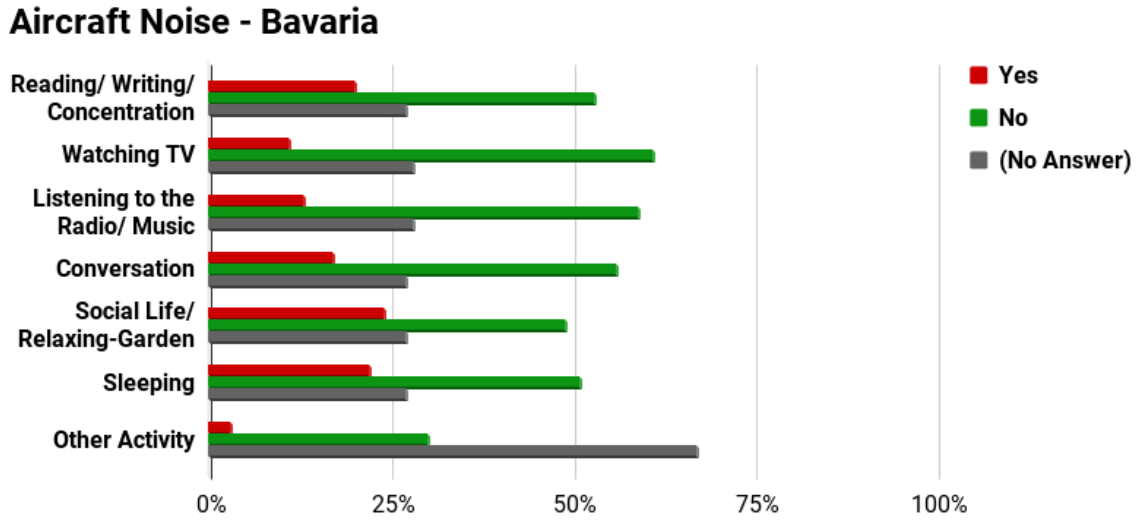

Figure 6.26.: Which Respondents' Activities are Annoyed by Aircraft Noise (Q15b)

Aircraft noise disturbs 24% of the respondents from their social life or relaxing in the garden, 22 from sleeping, 20% from reading, writing or concentration, and also from other activities.

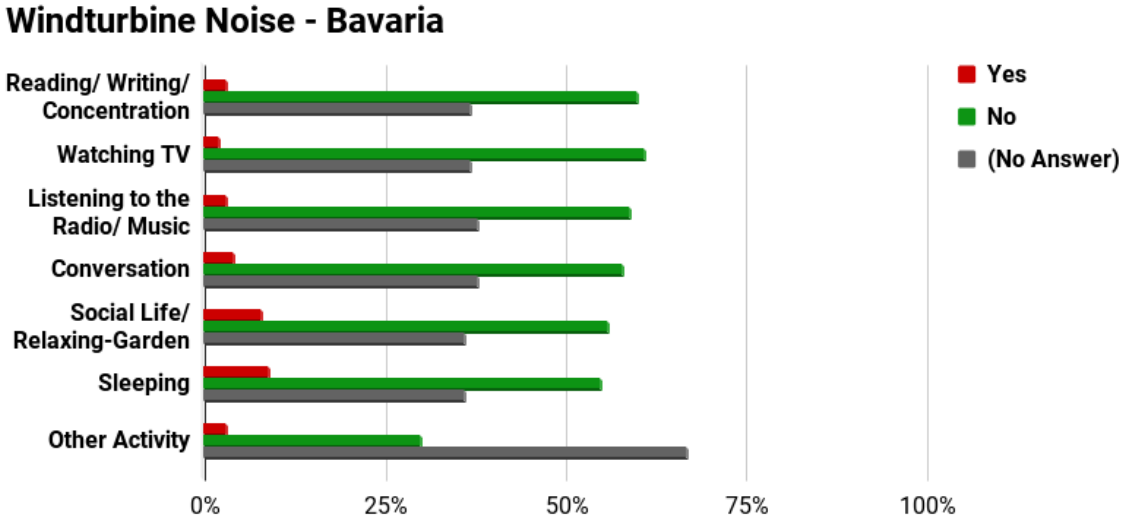

Figure 6.27.: Which Respondents' Activities are Annoyed by Wind turbine Noise (Q15c)

Wind turbine noise is disturbing for people living in affected areas, but on average does not reach as high numbers as road traffic noise or aircraft noise.

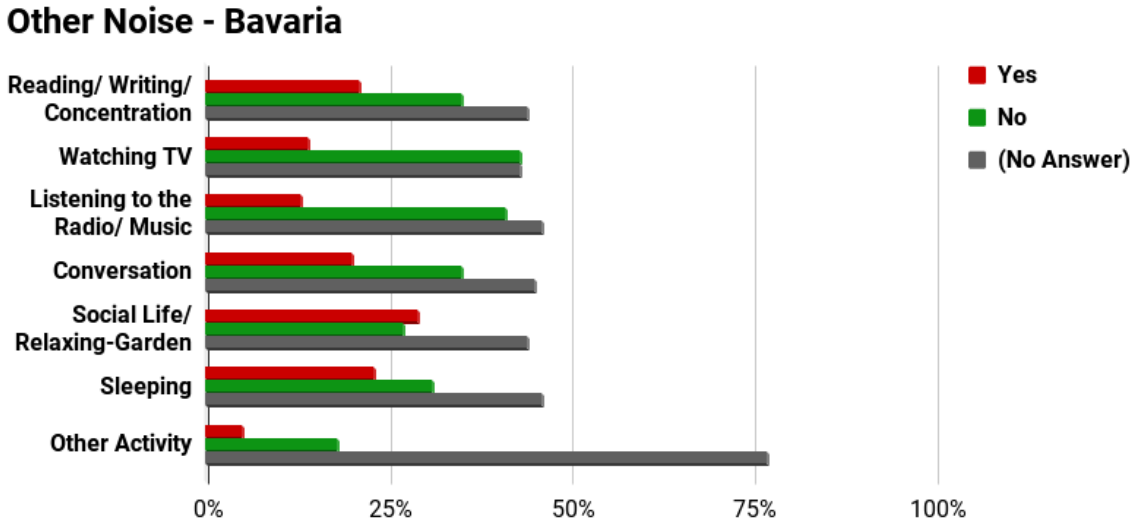

Figure 6.28.: Which Respondents' Activities are Annoyed by Other Noise (Q15d)

As other noise sources were named trains, respondents' neighbors and children, agricultural machinery and building construction.

- **Question Q16 This noise source always:** (road traffic noise, aircraft noise, wind turbine noise and other noise)

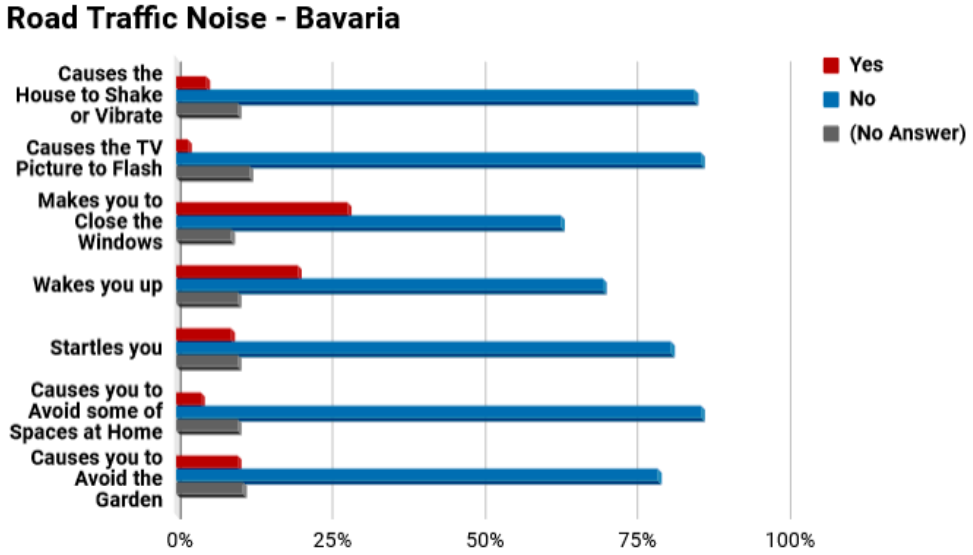

Figure 6.29.: Respondents' Discomfort Caused by Road Traffic Noise (Q16a)

The most frequent action that the road traffic noise causes the respondents to do is closing the windows. Windows are closed owing to this noise source by about 28% of the respondents. The road traffic noise wakes up 20% of the respondents.

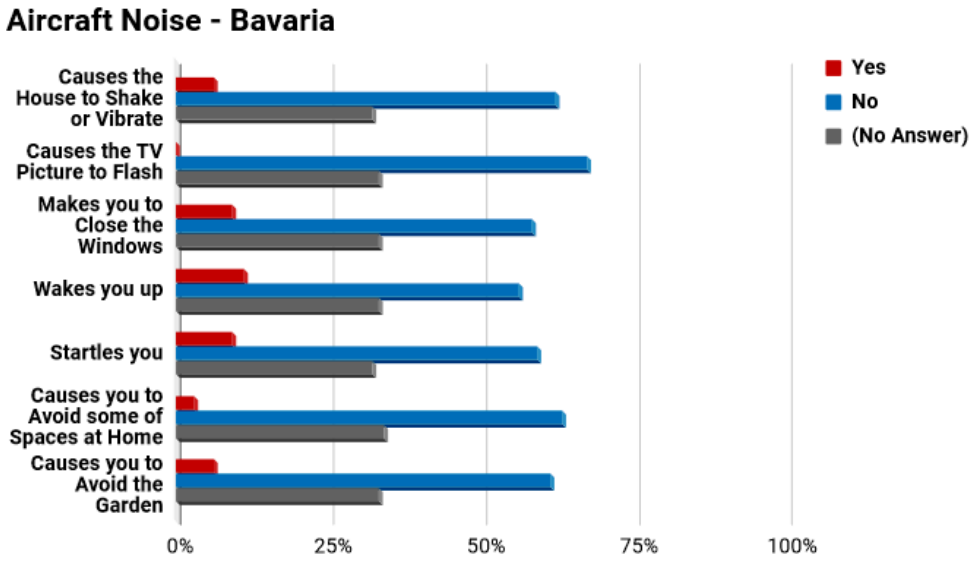

Figure 6.30.: Respondents' Discomfort Caused by Aircraft Noise (Q16b)

Aircraft noise and wind turbine noise cause inconveniences to smaller groups of respondents than the road traffic noise.

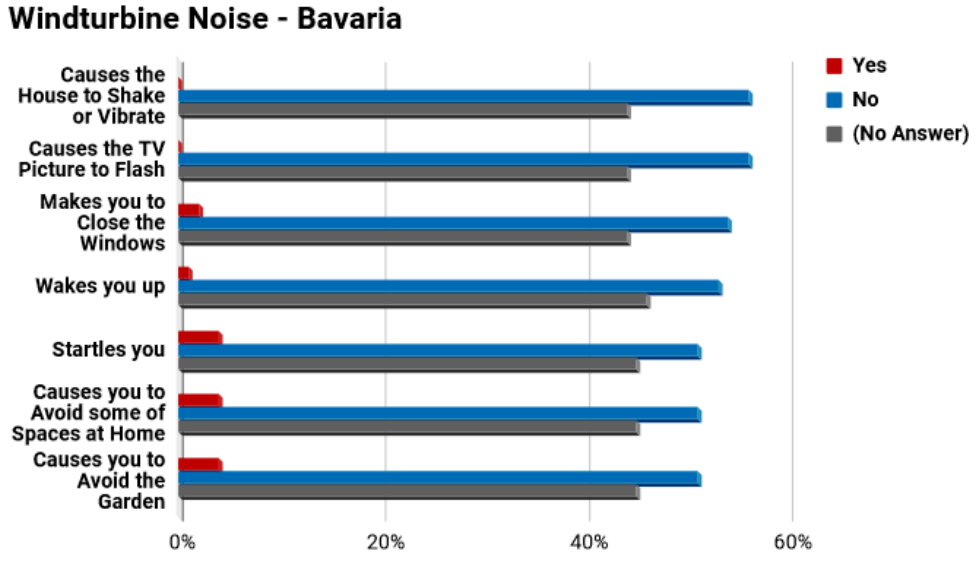

Figure 6.31.: Respondents' Discomfort Caused by Wind Turbine Noise (Q16c)

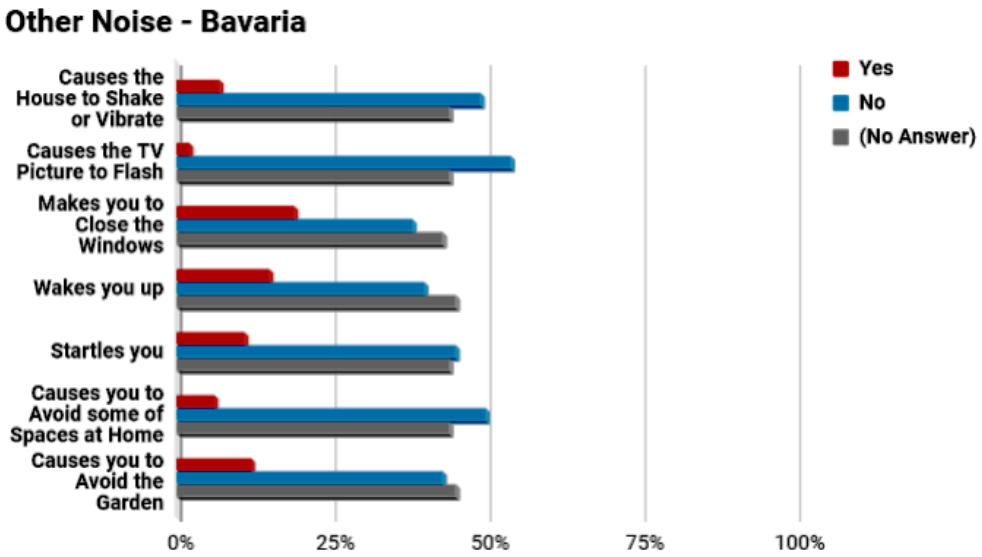

Figure 6.32.: Respondents' Discomfort Caused by "Other Noise" (Q16d)

6.3. Summary of the Results

6.3.1. Importance of Factors which can Influence Quality of Life

The most important factors evaluated as extremely or very important in the Czech Republic and Bavaria are considered availability of green spaces or countryside (86%), personal safety (84%), air quality (81%), local level of criminality (74%), and road traffic noise experienced at home (71%). The results of the community survey undertaken by Faber Maunsell on behalf of Belfast City Airport in 2003 show quite different order of respondents' priorities. Feeling of personally secure is extremely or very important to 97% of respondents from Belfast, and almost as important are local crime rates (95%) and street cleanliness (92%). Street cleanliness is extremely or very important only for 37% of Bavarian respondents and for 61% respondents from the Czech Republic.

As least important were mentioned wind turbines (extremely or very important to 35%), and availability of local recreation facilities (34%) in the Czech Republic and Bavaria, and noise produced by railways (27%) and access to jobs (46%) in Belfast. Availability of local medical care (40%) or quality of a local school (48%) were evaluated as not so important for the respondents too.

The aircraft noise was stated as extremely or very important by 42% respondents from the Czech Republic, and 44% respondents from Belfast. Aircraft noise is more important for respondents

from Bavaria (71%) than from Belfast, although the second survey was carried out the nearby large airport. Road traffic noise is similarly important in all three surveys. [96]

6.3.2. Satisfaction with Factors which can Influence Quality of Life

The respondents from both countries were generally satisfied with the quality of life at the place, where they live. The mean scores of satisfaction with the quality of life aspects were all quite low and are depicted in **Fig. 6.33**. As most dissatisfactory was stated the amount of road traffic with the mean of 2.5, where one means very satisfied and five means very dissatisfied.

The respondents from Belfast survey seemed to be less satisfied with the quality of life in the aircraft noise affected areas.Over 50% of respondents were dissatisfied with levels of crime, 30 % were dissatisfied with a condition of roads and pavements, and over 80% were dissatisfied with the level of local rates. Satisfaction with local rates has not been included in surveys carried out in the Czech Republic and Bavaria, so it is not possible to compare this aspect. Aircraft noise is less of a cause of dissatisfaction than many other aspects, with almost 60% being satisfied. However, 10% were dissatisfied and a further 5% are very dissatisfied. [96]

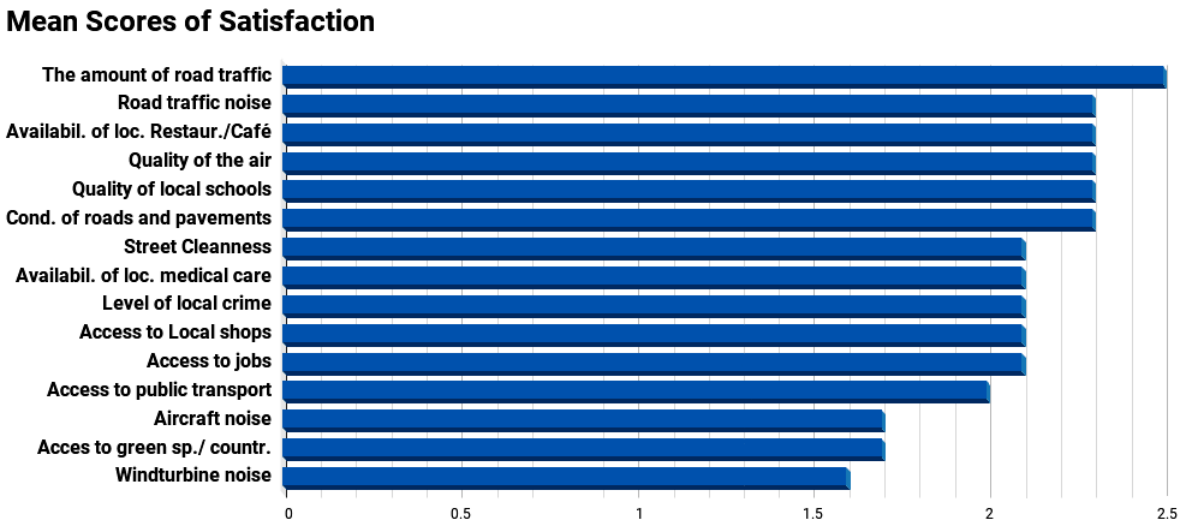

Figure 6.33.: Mean Scores of Satisfaction with Quality of Life Aspects in the Czech Republic and Bavaria

6.3.3. Environmental Noise Sources - Noticing, Noisiness and Annoyance

As the most noticed noise in the Czech Republic as well as in Bavaria was considered the road traffic noise, followed by motorbikes and mopeds. Road transport represents an extremely or very noisy source of noise for 27% respondents from the Czech Republic and for 23% from Bavaria.

Motorbikes or mopeds are extremely or very noisy for 27% respondents from the Czech Republic and 32% of Bavarian respondents. The road traffic noise was also rated as the most annoying within the last 12 months. In Bavaria, there was road traffic noise at least moderately annoying by 35% respondents and in the Czech Republic by 27% respondents.

Similarly, in Belfast, road traffic noise was stated as the most commonly noticed, followed by children playing, and sirens from emergency vehicles. Motorbikes or mopeds (25%), and road traffic noise (22%) are the most usual noise sources in Belfast rated as extremely or very noisy. Airplanes were evaluated as very or extremely noisy only by 10% and 7% of respondents respectively. Although this does vary by area. 29% of respondents from Belfast considered airplanes as not at all noisy. [96]

A wind power plant is the least encountered noise source by Czech and Bavarian respondents. At the same time, it is considered to be the least annoying noise source. The respondents living in areas, where this source of noise is present, are an exception. They consider the wind turbine to be very noisy and they encounter this noise source often. The noise of airplanes and trains people hear less frequently and do not consider it so noisy or disturbing as the road traffic noise.

The individual environmental noise sources are ranked according to the mean values and are depicted in **Fig. 6.34**, where one means "never noticed", and five means "all the time noticed", **Fig. 6.35** and **Fig. 6.36**, where one indicates "not at all" noisy or annoying, and five stands for "extremely" noisy or annoying.

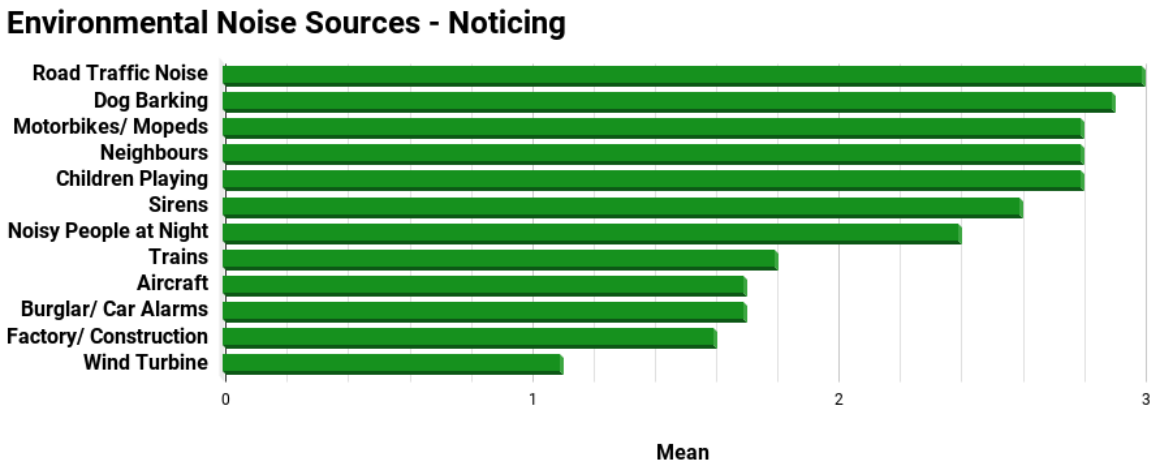

Figure 6.34.: Frequency of Noticing Selected Noise Sources - Mean Scores (Q7)

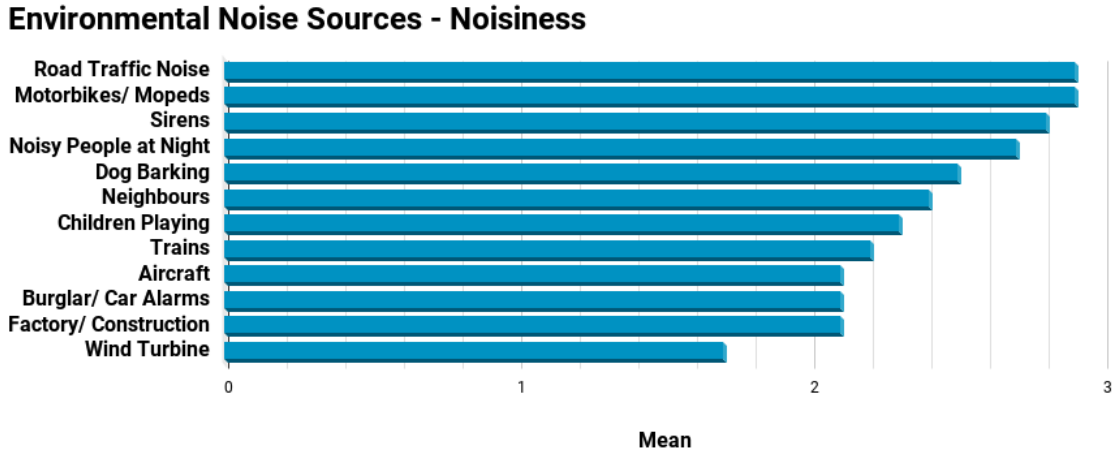

Figure 6.35.: Mean Scores of Noisiness of Selected Environmental Noise Sources (Q8)

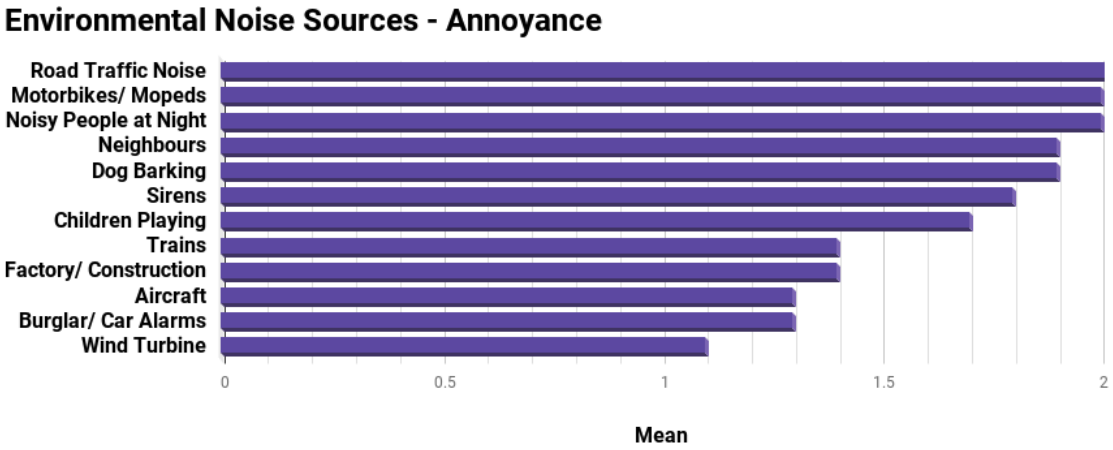

Figure 6.36.: Mean Scores of Annoyance by Selected Environmental Noise Sources within the Last 12 Months (Q12)

6.3.4. Respondents' Local Areas - Noisiness, Level of Noise Annoyance and Noise Levels over the Last 12 Months

On average, respondents regarded the locality where they live, as more than slightly noisy. The mean value equals 2.3. The environmental noise in the place where the participants live was on average appraised as slightly annoying with a mean value of two. For both issues one implies not at all (noisy or annoying), two means slightly, three moderately, four very, and five extremely. The participants mostly reported that the noise level in their place remained about the same within the last 12 months.

6.3.5. Disturbance of Respondents‘ Activities by Selected Environmental Noise Sources

Respondents from the Czech Republic and Bavaria were more likely to be disturbed by traffic noise than aircraft noise when doing their daily activities alike respondents from Belfast. Aircraft noise disturbs more respondents from Belfast (aircraft noise affected area) than from Bavaria or from the Czech Republic.

The proportion of Bavarian and Czech "yes" answers to disturbance of respondents' activities dependent on the environmental noise, is captured in a three-dimensional histogram disclosed in **Fig. 6.37**. Most of the respondents are annoyed by road traffic, aircraft noise follows, and wind turbines are much less noticed.

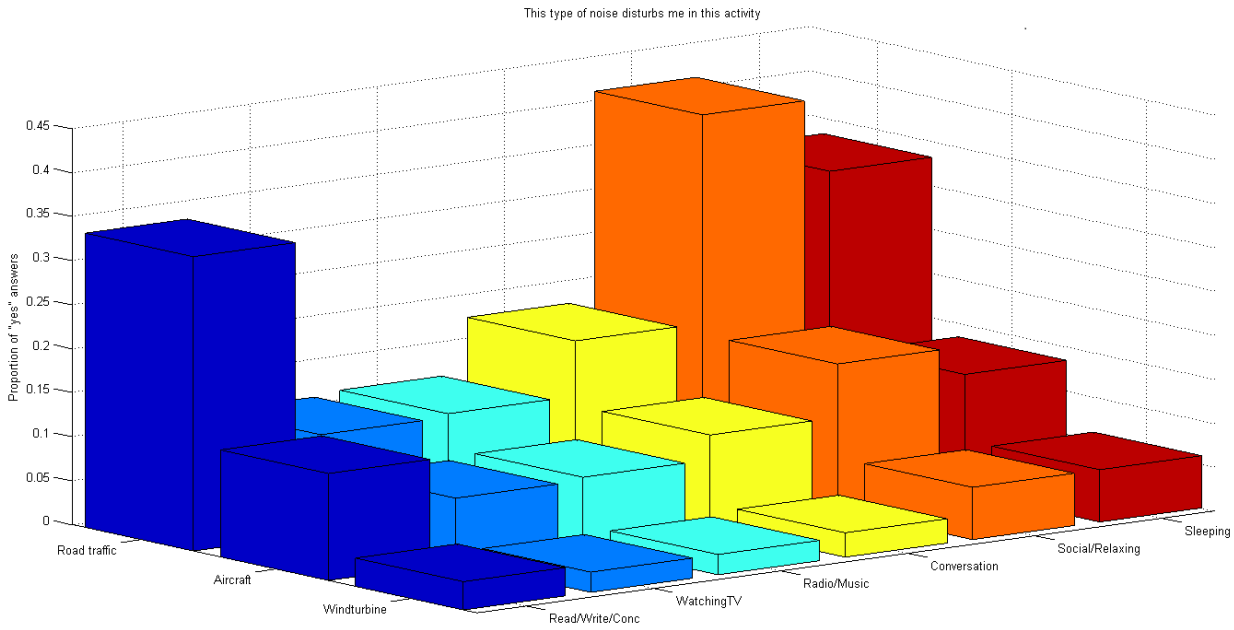

Figure 6.37.: Which Respondents' Activities are Annoyed by Environmental Noise (Q15)

6.3.6. Discomfort Caused by Environmental Noise

Representation of positive responses to the discomfort of participants in both surveys, caused by three focused environmental noise sources, is depicted in a three-dimensional graph in figure **Fig. 6.38**. This histogram points out that the road traffic noise often causes the participants of both surveys to close their windows. This noise source is also capable of waking people up or cause their house to shake or vibrate.

Aircraft noise bothers people in a similar way to road traffic noise. In addition, the noise

of aircraft can also startle people. This noise source is noticed by a much smaller number of respondents than road traffic noise.

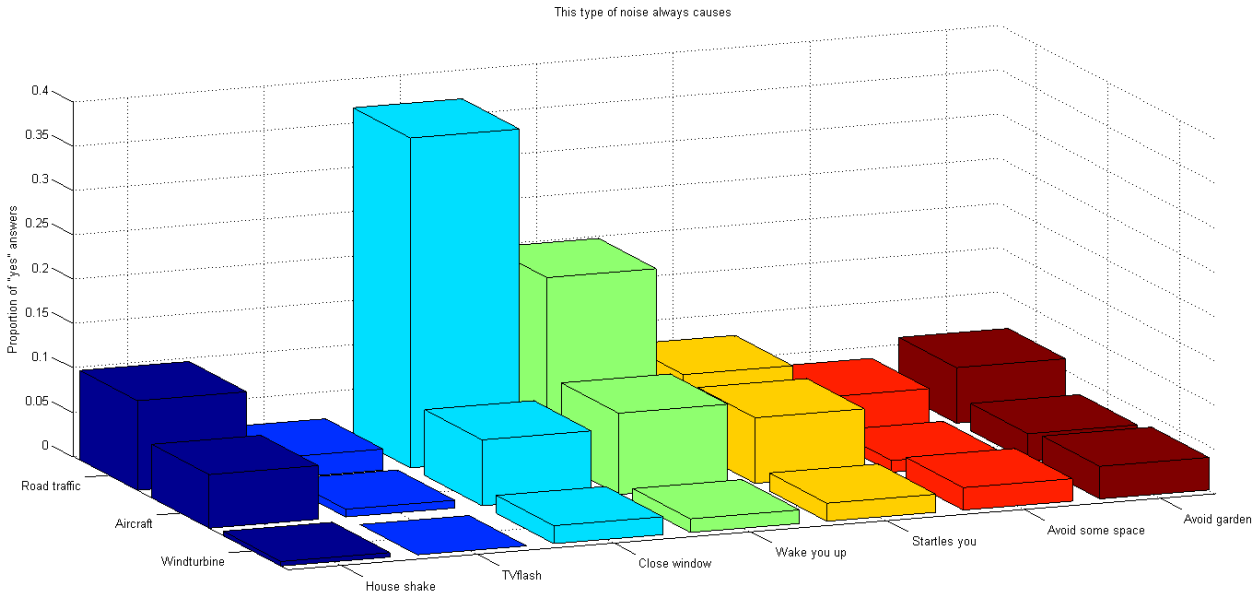

Figure 6.38.: Respondents' Discomfort Caused by Environmental Noise (Q16)

6.4. Data Analysis

Analysis of variance

Selected questions of the survey will be evaluated by the analysis of variance (ANOVA). This analysis is used to determine whether there are any statistically significant differences between means of more than two independent groups. Using F-tests, ANOVA enables to calculate the equality of means. Thereby, a statistical test (called F-ratio or F-statistic) to obtain a probability (P-value) is carried out. F-tests are based on the ratio of mean squares (MS). The P-value is the probability that the null hypothesis is true. [98]

The F-value is used to test the hypothesis that the means are significantly different from each other. Since both the F_{crit} for the rows and for the columns are lower than the respective F-values for the rows and for the columns, their means are significantly different. The P-value should also be less than 0.05 to claim, that the results of the hypothesis test are significant. [98]

The data from the respondents were divided into groups by gender, age, the level of education, marital status, employment status, satisfaction with monthly income, and the size of the municipality where the respondents live.

The following analysis is focused on issues related to the satisfaction with factors influencing the quality of life in respondents' local areas, the perception of noise from selected sources, and annoyance by the selected environmental noise sources.

For each combination of the monitored group and the focused issue, the null and the alternative hypotheses were established.

Correlation analysis

The correlation analysis was used to explore relationships between selected noise issues and socioeconomic groups because the correlation signifies that there is a tendency of the values of one variable to occur together with certain values of the second variable. More precisely, Spearman's Rank Correlation, which does not assume in contrast with Pearson's Correlation any assumptions about the distribution of the data, was used. [99]

Spearman's correlation coefficient ("rho" or "ρ") allows identifying the strength and direction of a monotonic relationship between two data sets. The value of the Spearman's correlation coefficient ranges from -1 to +1. The closer the coefficient to $\pm$ 1 is, the stronger the correlation will be. When the value of the correlation coefficient goes towards 0, the relationship between the two variables will be weaker. The sings plus and minus indicate a positive or a negative relationship between the two datasets. The p-value indicates how the correlation is significant. If the p-value is less than 0.05, the correlation is significant. [99][100]

The null and the alternative hypotheses were defined for each issue.

6.4.1. Satisfaction with Factors which can Influence Quality of Life in Respondents' Local Areas

The data analyzed in this subsection were gathered according to question Q6, which inquires how satisfied are people with the factors influencing the quality of life in their local area. Not all factors, which were prepared, for these surveys, were investigated. All monitored groups evaluated six factors influencing the quality of life.The focus was on the noise issues and other three factors which were evaluated as the most important regarding question Q5. The following hypotheses were established for all the monitored groups.

Null hypothesis:

H_0: The monitored group to which a respondent belongs, will have no statistically significant effect on the evaluation of satisfaction with the factor influencing the quality of life.

H_0: The type of factor influencing the quality of life will have no statistically significant effect on the evaluation of satisfaction.

Alternative hypothesis:

H_1: The monitored group to which a respondent belongs, does have a statistically significant effect on the evaluation of satisfaction with the factors influencing the quality of life.

H_1: The type of factor influencing the quality of life does have a statistically significant effect on the evaluation of satisfaction.

The Gender of Respondents

In this case, two groups of respondents - men and women - are represented. Two-Way ANOVA (Two-Factor ANOVA) without replication was used to determine whether there are any statistically significant differences between means of genders. The results of the analysis of variance are summarized in the **Tab. 6.3** and **Tab. 6.4**.

The F-values for columns are greater than the corresponding F_{crit} values ($F_{crit} > F$), and the P-value are greater than 0.05 (P-Value > 0.05). That means, that there is no significant difference between the two genders and the null hypothesis is not rejected.

Table 6.3.: The Impact of Respondents' Gender on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in the Czech Republic

Q6 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	2	6,952	3,476	0,034
Road Traffic Noise	2	7,186	3,593	0,000
Quality of the Air	2	7,257	3,629	0,010
Aircraft Noise	2	8,547	4,273	0,017
Feelings of Personal Safety	2	8,259	4,129	0,010
Wind Turbine Noise	2	8,780	4,390	0,005
Acces to green sp./ Countryside	2	8,579	4,289	0,001
Female	7	27,437	3,920	0,177
Male	7	28,122	4,017	0,129

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,797	6	0,300	41,456	**0,00013**	4,284
Columns	0,034	1	0,034	4,648	**0,07450**	5,987
Error	0,043	6	0,007			
Total	1,874	13				

Table 6.4.: The Impact of Respondents' Gender on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in Bavaria

Q6 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	2	7	3,737	0,001
Road Traffic Noise	2	8	3,807	0,003
Quality of the Air	2	8	3,974	0,005
Aircraft Noise	2	9	4,403	0,109
Feelings of Personal Safety	2	8	4,086	0,005
Wind Turbine Noise	2	9	4,591	0,017
Acces to green sp./ Countryside	2	9	4,379	0,025
Female	7	29	4,087	0,101
Male	7	29	4,191	0,131

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,269	6	0,211	10,154	**0,00627**	4,284
Columns	0,038	1	0,038	1,828	**0,22513**	5,987
Error	0,125	6	0,021			
Total	1,4318	13				

The Age of Respondents

The respondents were divided into two age categories - up to 30 years old and over 30 years old. The hypothesis was tested in the same way (using Two-Way ANOVA) as it was shown in the previous paragraph.

In the **Tab. 6.5**, the F-value of columns is greater than the appendant F_{crit} value for columns ($F_{crit} > F$) and the P-value is greater than 0.05 (P-Value > 0.05). That means, that there is no significant difference between the two age groups in the Czech Republic and the null hypothesis is not rejected.

In contrast to that, in Bavaria appeared a significant effect on the evaluation according to age groups. F_{crit} for columns in the **Tab. 6.6** is lower than F ($F_{crit} < F$) and the P-value is lower than 0.05 (P-value < 0.05). The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The age of respondents does have a statistically significant effect on the evaluation of satisfaction with the factors influencing the quality of life in Bavaria.

Table 6.5.: The Impact of Respondents' Age on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in the Czech Republic

Q6 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	2	6,934	3,467	0,004
Road Traffic Noise	2	7,172	3,586	0,001
Quality of the Air	2	7,332	3,666	0,044
Aircraft Noise	2	8,569	4,285	0,003
Feelings of Personal Safety	2	8,260	4,130	0,000
Wind Turbine Noise	2	8,719	4,359	0,029
Acces to green sp./ Countryside	2	8,615	4,307	0,011
<= 30 years old	7	27,731	3,962	0,162
> 30 years old	7	27,869	3,981	0,147

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,766	6	0,294	19,668	**0,00105**	4,284
Columns	0,001	1	0,001	0,091	**0,77334**	5,987
Error	0,090	6	0,015			
Total	1,857	13				

Table 6.6.: The Impact of Respondents' Age on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in Bavaria

Q6 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	2	7	3,604	0,227
Road Traffic Noise	2	7	3,729	0,090
Quality of the Air	2	8	3,857	0,168
Aircraft Noise	2	9	4,378	0,000
Feelings of Personal Safety	2	8	4,059	0,007
Wind Turbine Noise	2	9	4,576	0,001
Acces to green sp./ Countryside	2	9	4,362	0,033
<= 30 years old	7	28	3,929	0,236
>30 years old	7	30	4,232	0,069

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,628	6	0,271	7,945	**0,01173**	4,284
Columns	0,322	1	0,322	9,427	**0,02193**	5,987
Error	0,205	6	0,034			
Total	2,155	13				

The Education Level

This time, responses were divided into five groups according to the respondents' level of education - basic education, secondary education with an apprenticeship certificate, secondary education with Matura exam, higher professional education, and higher education or university degree. The results of the analysis of variance are summarized in the **Tab. 6.7** and **Tab. 6.8**.

The F-value of columns is greater than the corresponding F_{crit} value for columns ($F_{crit} > F$) and the P-value is greater than 0.05 (P-value > 0.05). That means, that the respondents with different level of education did not evaluate the satisfaction with the factors influencing the quality of life in a statistically significant different way. The null hypothesis is not rejected in this case.

Table 6.7.: The Impact of the Level of Respondents' Education on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in the Czech Republic

Q6 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	5	17,582	3,516	0,076
Road Traffic Noise	5	17,686	3,537	0,170
Quality of the Air	5	18,594	3,719	0,022
Aircraft Noise	5	21,424	4,285	0,021
Feelings of Personal Safety	5	20,791	4,158	0,009
Wind Turbine Noise	5	21,033	4,207	0,102
Acces to green sp./ Countryside	5	20,742	4,148	0,052
Basic education	7	28,680	4,097	0,079
Sec. ed. with app. certificate	7	26,033	3,719	0,271
Sec. ed. with Matura exam	7	27,627	3,947	0,164
Higher professional ed.	7	27,657	3,951	0,081
Higher ed./ University degree	7	27,854	3,979	0,178

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,358	6	0,560	10,499	**9,83E-06**	2,508
Columns	0,527	4	0,132	2,469	**0,07188**	2,776
Error	1,279	24	0,053			
Total	5,164	34				

Table 6.8.: The Impact of the Level of Respondents' Education on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in Bavaria

Q6 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	5	18,847	3,769	0,074
Road Traffic Noise	5	19,255	3,851	0,034
Quality of the Air	5	21,103	4,221	0,281
Aircraft Noise	5	23,238	4,648	0,106
Feelings of Personal Safety	5	21,366	4,273	0,172
Wind Turbine Noise	5	21,917	4,383	0,644
Acces to green sp./ Countryside	5	22,669	4,534	0,087
Basic education	7	30,250	4,321	0,223
Sec. ed. with app. certificate	7	29,513	4,216	0,044
Sec. ed. with Matura exam	7	29,018	4,145	0,377
Higher professional ed.	7	31,000	4,429	0,619
Higher ed./ University degree	7	28,614	4,088	0,120

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,236	6	0,539	2,557	**0,04662**	2,508
Columns	0,524	4	0,131	0,621	**0,65179**	2,776
Error	5,064	24	0,211			
Total	8,824	34				

The Marital Status

To investigate the effect of marital status on the evaluation of satisfaction with factors influencing the quality of life, the standardized means and medians were also compared. The types of marital status, as well as the Two-Way ANOVA results, are listed in the **Tab. 6.9** and **Tab. 6.10**.

The P-value for columns delineated in both Tables is lower than 0.05 (P-Value < 0.05) and F_{crit} is lower than F ($F_{crit} < F$). That signifies, that there is a difference between the different marital statuses. The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The marital status of respondents does have a statistically significant effect on the evaluation of satisfaction with the factors influencing the quality of life in both countries.

Table 6.9.: The Impact of Respondents' Marital Status on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in the Czech Republic

Q6 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	4	13,398	3,350	0,054
Road Traffic Noise	4	13,844	3,461	0,047
Quality of the Air	4	14,720	3,680	0,067
Aircraft Noise	4	16,945	4,236	0,006
Feelings of Personal Safety	4	16,017	4,004	0,078
Wind Turbine Noise	4	17,017	4,254	0,077
Acces to green sp./ Countryside	4	16,705	4,176	0,057
Single	7	28,447	4,064	0,126
Married	7	27,569	3,938	0,193
In any partner cohabitation	7	26,699	3,814	0,205
Divorced	7	25,932	3,705	0,162

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,469	6	0,578	16,071	**2,4E-06**	2,661
Columns	0,506	3	0,169	4,689	**0,01369**	3,160
Error	0,648	18	0,036			
Total	4,623	27				

Table 6.10.: The Impact of Respondents' Marital Status on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in Bavaria

Q6 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	5	18,297	3,659	0,247
Road Traffic Noise	5	18,664	3,733	0,330
Quality of the Air	5	20,311	4,062	0,136
Aircraft Noise	5	20,979	4,196	0,481
Feelings of Personal Safety	5	20,436	4,087	0,005
Wind Turbine Noise	5	22,296	4,459	0,073
Acces to green sp./ Countryside	5	21,469	4,294	0,056
Single	7	27,357	3,908	0,288
Married	7	29,562	4,223	0,086
In any partner cohabitation	7	29,333	4,190	0,054
Divorced	7	31,200	4,457	0,050
Widow	7	25,000	3,571	0,286

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	2,501	6	0,417	4,819	**0,00234**	2,508
Columns	3,238	4	0,810	9,361	**0,00010**	2,776
Error	2,076	24	0,086			
Total	7,815	34				

The Employment Status

The **Tab. 6.11** depicts the Two-Way ANOVA results for nine employment categories - employee, student, self-employed or freelancer of private farmer, the owner of a company with employees, the owner of a company without any employees, housewife, working pensioner, retired, and unemployed represented in the Czech Republic. In the **Tab. 6.12,** there are three of nine categories mentioned above not represented - the owner of a company without any employees, retired, and unemployed.

Table 6.11.: The Impact of Respondents' Employment Status on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in the Czech Republic

Q6 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	9	31,422	3,491	0,106
Road Traffic Noise	9	30,848	3,428	0,085
Quality of the Air	9	32,561	3,618	0,112
Aircraft Noise	9	37,162	4,129	0,128
Feelings of Personal Safety	9	36,730	4,081	0,043
Wind Turbine Noise	9	37,112	4,124	0,524
Acces to green sp./ Countryside	9	36,807	4,090	0,431
Employee	7	27,440	3,920	0,177
Student	7	28,501	4,072	0,131
Self-employed, Freelancer, Private farme	7	28,117	4,017	0,168
The owner of a company with employees	7	28,333	4,048	0,238
Housewife	7	26,300	3,757	0,443
Working pensioner	7	26,500	3,786	0,488
Retired	7	27,117	3,874	0,290
Unemployed	7	27,333	3,905	0,323
The owner of a company without employ	7	23,000	3,286	0,053

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	5,621	6	0,937	5,456	**0,00023**	2,295
Columns	3,189	8	0,399	2,321	**0,03413**	2,138
Error	8,243	48	0,172			
Total	17,053	62				

In both **Tab. 6.11** and **Tab. 6.12**, the P-value for columns is highlighted. It is lower than 0.05 (P-value < 0.05). Also, F_{crit} is lower than F ($F_{crit} < F$). Therefore can be stated, that the employment status of respondents influences the evaluation of satisfaction with the quality of life factors in a statistically significant different way. The null hypothesis is rejected and the

alternative hypothesis is accepted.

H_1: The employment status of respondents does have a statistically significant effect on the evaluation of satisfaction with the factors influencing the quality of life in both countries.

Table 6.12.: The Impact of Respondents' Employment Status on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in Bavaria

Q6 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	6	22,520	3,753	0,350
Road Traffic Noise	6	23,768	3,961	0,550
Quality of the Air	6	22,408	3,735	1,201
Aircraft Noise	6	27,456	4,576	0,123
Feelings of Personal Safety	6	24,957	4,160	0,290
Wind Turbine Noise	6	29,110	4,852	0,041
Acces to green sp./ Countryside	6	24,571	4,095	1,187
Employee	7	29,148	4,164	0,092
Student	7	26,000	3,714	0,534
Self-empl., Freelancer, Private farmer	7	24,000	3,429	1,619
The owner of a company with empl.	7	34,000	4,857	0,143
Housewife	7	30,143	4,306	0,105
Working pensioner	7	31,500	4,500	0,083

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	6,248	6	1,041	3,391	**0,01131**	2,421
Columns	9,496	5	1,899	6,184	**0,00047**	2,534
Error	9,213	30	0,307			
Total	24,957	41				

The Satisfaction with Monthly Income

The respondents of both surveys had five options how to express their satisfaction with their monthly income - very satisfied, satisfied, quite satisfied, dissatisfied, and very dissatisfied. All these options are listed in the two following tables as well as the Two-Way ANOVA results.

In the **Tab. 6.13**, the F-value of columns is lower than the appendant F_{crit} value for columns ($F_{crit} < F$) and the P-Value is lower than 0.05 (P-value < 0.05). Accordingly, it may be deduced that the satisfaction with monthly income in the Czech Republic statistically significant effects

the satisfaction with the factors influencing the quality of life. The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The Respondents' satisfaction with monthly income does have a statistically significant effect on the evaluation of satisfaction with the factors influencing the quality of life in the Czech Republic.

Table 6.13.: The Impact of Respondents' Satisfaction with Monthly Income on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in the Czech Republic

Q6 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	5	19,308	3,862	0,066
Road Traffic Noise	5	19,306	3,861	0,029
Quality of the Air	5	19,785	3,957	0,008
Aircraft Noise	5	21,358	4,272	0,043
Feelings of Personal Safety	5	20,298	4,060	0,053
Wind Turbine Noise	5	23,503	4,701	0,048
Acces to green sp./ Countryside	5	20,390	4,078	0,183
Very dissatisfied	7	29	4,071	0,202
Dissatisfied	7	29	4,145	0,210
Quite satisfied	7	28	4,061	0,173
Satisfied	7	29	4,101	0,062
Very satisfied	7	29	4,186	0,065

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	4,016	6	0,669	48,489	**3,017E-12**	2,508
Columns	1,005	4	0,251	18,210	**5,383E-07**	2,776
Error	0,331	24	0,014			
Total	5,353	34				

On the contrary, in the **Tab. 6.14** can be seen that the F-value of columns is greater than the corresponding F_{crit} value for columns ($F_{crit} > F$) and the P-value is greater than 0.05 (P-value $>$ 0.05). That shows, that in Bavaria there is no statistically significant effect on the satisfaction with monthly income on the evaluation of satisfaction with the quality of life factors. The null hypothesis is not rejected in this case.

Table 6.14.: The Impact of Respondents' Satisfaction with Monthly Income on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in Bavaria

Q6 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	5	19,308	3,862	0,066
Road Traffic Noise	5	19,306	3,861	0,029
Quality of the Air	5	19,785	3,957	0,008
Aircraft Noise	5	21,358	4,272	0,043
Feelings of Personal Safety	5	20,298	4,060	0,053
Wind Turbine Noise	5	23,503	4,701	0,048
Acces to green sp./ Countryside	5	20,390	4,078	0,183
Very dissatisfied	7	29	4,071	0,202
Dissatisfied	7	29	4,145	0,210
Quite satisfied	7	28	4,061	0,173
Satisfied	7	29	4,101	0,062
Very satisfied	7	29	4,186	0,065

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	2,627	6	0,438	6,397	**0,00040**	2,508
Columns	0,076	4	0,019	0,277	**0,88993**	2,776
Error	1,643	24	0,068			
Total	4,345	34				

The Size of Municipality

The municipalities, where the respondents live, were divided into five groups according to size. All five groups are listed in the **Tab. 6.15** and **Tab. 6.16** together with the results of the analysis of variance.

In the **Tab. 6.15**, the F-value of columns is greater than the appendant F_{crit} value for columns ($F_{crit} > F$) and the P-value is greater than 0.05 (P-value > 0.05). That shows, that there is no significant difference between respondents coming from differently sized municipalities in the Czech Republic and the null hypothesis is not rejected.

In contrast to that, a significant effect on the evaluation according to the size of a municipality appeared in Bavaria. F_{crit} for columns in the **Tab. 6.16** is lower than F ($F_{crit} < F$) and the P-value is lower than 0.05 (P-value < 0.05). The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The Respondents' Size of Municipality does have a statistically significant effect on the evaluation of satisfaction with the factors influencing the quality of life in Bavaria.

Table 6.15.: The Impact of Respondents' Size of Municipality on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in the Czech Republic

Q6 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	5	17,730	3,546	0,014
Road Traffic Noise	5	18,146	3,629	0,007
Quality of the Air	5	18,644	3,729	0,220
Aircraft Noise	5	21,640	4,328	0,009
Feelings of Personal Safety	5	20,884	4,177	0,033
Wind Turbine Noise	5	21,525	4,305	0,098
Acces to green sp./ Countryside	5	21,746	4,349	0,010
Up to 999 inhabitants	7	28,554	4,079	0,123
1000 - 4999 inhabitants	7	28,373	4,053	0,156
5000 - 19 999 inhabitants	7	28,565	4,081	0,171
20 000 - 99 999 inhabitants	7	27,523	3,932	0,227
100 000 and more inhabitants	7	27,301	3,900	0,189

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,851	6	0,642	11,365	**5,09E-06**	2,508
Columns	0,209	4	0,052	0,925	**0,46608**	2,776
Error	1,356	24	0,056			
Total	5,416	34				

Table 6.16.: The Impact of Respondents' Size of Municipality on the Evaluation of Satisfaction with Factors Influencing the Quality of Life in Bavaria

Q6 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
The amount of Road Traffic	5	18,736	3,747	0,280
Road Traffic Noise	5	19,027	3,805	0,230
Quality of the Air	5	19,752	3,950	0,571
Aircraft Noise	5	21,760	4,352	0,034
Feelings of Personal Safety	5	20,740	4,148	0,093
Wind Turbine Noise	5	22,799	4,560	0,018
Acces to green sp./ Countryside	5	21,941	4,388	0,098
Up to 999 inhabitants	7	31,200	4,457	0,033
1000 - 4999 inhabitants	7	30,864	4,409	0,085
5000 - 19 999 inhabitants	7	29,732	4,247	0,029
20 000 - 99 999 inhabitants	7	27,876	3,982	0,191
100 000 and more inhabitants	7	25,083	3,583	0,426

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	2,925	6	0,488	7,054	**0,00020**	2,508
Columns	3,635	4	0,909	13,147	**8,28E-06**	2,776
Error	1,659	24	0,069			
Total	8,219	34				

Conclusions:

Using the analysis of variance determined, that marital and employment status of respondents have a statistically significant effect on the evaluation of satisfaction with the factors influencing the quality of life in both focused countries.

The analysis results were inconsistent for other criteria according to which the satisfaction ratings were evaluated. In the Czech Republic, there was a significant impact of the respondents' satisfaction with monthly income on the responses, but in Bavaria, there was the result exactly the opposite, and there was no influence of the satisfaction with monthly income with the probability of 89%. The age group and the size of respondents' municipality statistically affected the satisfaction ratings only in Bavaria. Gender and the level of education had no influence on the responses addressed to the satisfaction.

In all cases above, the P-value of rows was lower than 0.05 (P-value < 0.05) and also F_{crit} was lower than appendant F ($F_{crit} < F$). Therefore, it was determined, that there was a significant difference between evaluation of particular factors influencing the quality of life. The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The type of factor influencing the quality of life does have a statistically significant effect on the evaluation of satisfaction.

6.4.2. The Perception of Noisiness of Selected Environmental Noise Sources in Respondents' Local Areas

The data analyzed in this subsection were obtained from the answers to question Q8. This question investigated the perception of the noisiness of selected environmental noise sources in Respondents' Local Areas. It was elaborated on six focused noise sources: neighbors, road traffic, trains, aircraft, wind turbines, and factories. All monitored groups of respondents evaluated these six environmental noise sources. The question Q8 was also examined by the analysis of variance with two factors without replication and the following hypotheses were established for all the monitored groups.

Null hypotheses:

H_0: The monitored group to which a respondent belongs, will have no statistically significant effect on the perception of the noisiness of selected environmental noise source in Respondents' Local Areas.

H_0: The type of environmental noise source will have no significant effect on the perception of noisiness in Respondents' Local Areas.

Alternative hypotheses:

H_1: The monitored group to which a respondent belongs, does have a statistically significant effect on the perception of the noisiness of selected environmental noise source in Respondents' Local Areas.

H_1: The type of environmental noise source does have a significant effect on the perception of the noisiness in Respondents' Local Areas.

The Gender of Respondents

The results of the analysis of variance are listed in the **Tab. 6.17** and **Tab. 6.18**. In this case, the both F-values for columns are greater than the corresponding F_{crit} values for columns ($F_{crit} > F$) and the P-values are greater than 0.05 (P-value > 0.05). That means, that there is no significant difference between the two genders in both countries and the null hypothesis is not rejected.

Table 6.17.: The Impact of the Respondents' Gender on the Perception of Noise Produced by Selected Environmental Noise Sources in the Czech Republic

Q8 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	2	4,829	2,415	0,000
Road Traffic	2	5,835	2,918	0,002
Trains	2	4,252	2,126	0,001
Aircraft	2	4,225	2,112	0,001
Wind Turbine	2	3,278	1,639	0,000
Factory	2	4,321	2,160	0,003
Male	6	13,256	2,209	0,172
Female	6	13,483	2,247	0,183

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,772	5	0,354	916,525	2,13E-07	5,050
Columns	0,004	1	0,004	11,035	**0,020966**	6,608
Error	0,002	5	0,000			
Total	1,778	11				

Table 6.18.: The Impact of the Respondents' Gender on the Perception of Noise Produced by Selected Environmental Noise Sources in Bavaria

Q8 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	2	4,661	2,331	0,015
Road Traffic	2	5,665	2,833	0,000
Trains	2	4,685	2,342	0,043
Aircraft	2	4,624	2,312	0,035
Wind Turbine	2	3,414	1,707	0,145
Factory	2	4,127	2,063	0,083
Male	6	12,934	2,156	0,229
Female	6	14,243	2,374	0,081

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,373	5	0,275	7,701	**0,02140**	5,050
Columns	0,143	1	0,143	4,006	**0,10175**	6,608
Error	0,178	5	0,036			
Total	1,694	11				

The Age of Respondents

In the Czech Republic, the influence of age groups on noise perception was significant. F_{crit} for columns in the **Tab. 6.19** is lower than F ($F_{crit} < F$) and the P-value is lower than 0.05 (P-value < 0.05). The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The age of respondents does have a statistically significant effect on the perception of the noisiness of selected environmental noise source in Respondents' Local Areas in the Czech Republic.

In the **Tab. 6.20**, the F value of columns is greater than the appendant F_{crit} value for columns ($F_{crit} > F$) and the P-value is greater than 0.05 (P-value > 0.05). That means, that there is no significant difference between the two age groups in Bavaria and the null hypothesis is not rejected.

Table 6.19.: The Impact of the Respondents' Age on the Perception of Noise Produced by Selected Environmental Noise Sources in the Czech Republic

Q8 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	2	4,761	2,380	0,023
Road Traffic	2	5,736	2,868	0,014
Trains	2	4,174	2,087	0,015
Aircraft	2	4,144	2,072	0,010
Wind Turbine	2	3,302	1,651	0,005
Factory	2	4,187	2,094	0,030
<= 30 years old	6	13,577	2,263	0,197
> 30 years old	6	12,727	2,121	0,138

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,641	5	0,328	43,528	**0,00040**	5,050
Columns	0,060	1	0,060	7,977	**0,03692**	6,608
Error	0,038	5	0,008			
Total	1,739	11				

Table 6.20.: The Impact of the Respondents' Age on the Perception of Noise Produced by Selected Environmental Noise Sources in Bavaria

Q8 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	2	4,918	2,459	0,223
Road Traffic	2	5,859	2,930	0,118
Trains	2	4,575	2,288	0,027
Aircraft	2	4,459	2,229	0,076
Wind Turbine	2	3,298	1,649	0,026
Factory	2	4,095	2,048	0,000
<= 30 years old	6	13,742	2,290	0,349
>30 years old	6	13,462	2,244	0,107

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,816	5	0,363	3,925	**0,07986**	5,050
Columns	0,007	1	0,007	0,071	**0,80081**	6,608
Error	0,463	5	0,093			
Total	2,285	11				

The Education Level

The analysis of variance is encapsulated in **Tables 6.21** and **6.22.** In both cases, the P-value for columns is lower than 0.05 (P-value < 0.05), and F_{crit} is lower than appendant F ($F_{crit} < F$). That signifies, that there is a significant difference between the education level groups' perception of noise produced by selected environmental noise sources. The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The education level group of respondents does have a statistically significant effect on the perception of the noisiness of selected environmental noise source in Respondents' Local Areas.

Table 6.21.: The Impact of the Level of Respondents' Education on the Perception of Noise Produced by Selected Environmental Noise Sources in the Czech Republic

Q8 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	11,893	2,379	0,049
Road Traffic	5	13,628	2,726	0,058
Trains	5	9,491	1,898	0,148
Aircraft	5	9,437	1,887	0,075
Wind Turbine	5	8,448	1,690	0,023
Factory	5	9,970	1,994	0,128
Basic education	6	13,464	2,244	0,188
Sec. ed. with app. certificate	6	11,091	1,848	0,144
Sec. ed. with Matura exam	6	12,867	2,145	0,233
Higher professional ed.	6	11,656	1,943	0,216
Higher ed./ University degree	6	13,789	2,298	0,159

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,673	5	0,735	14,298	**5,07E-06**	2,711
Columns	0,900	4	0,225	4,376	**0,01054**	2,866
Error	1,028	20	0,051			
Total	5,601	29				

Table 6.22.: The Impact of the Level of Respondents' Education on the Perception of Noise Produced by Selected Environmental Noise Sources in Bavaria

Q8 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	10,721	2,144	0,135
Road Traffic	5	13,783	2,757	0,055
Trains	5	13,423	2,685	1,806
Aircraft	5	10,808	2,162	0,502
Wind Turbine	5	7,472	1,494	0,237
Factory	5	9,762	1,952	0,514
Basic education	6	9,375	1,563	0,286
Sec. ed. with app. certificate	6	12,832	2,139	0,210
Sec. ed. with Matura exam	6	11,125	1,854	0,428
Higher professional ed.	6	18,000	3,000	1,200
Higher ed./ University degree	6	14,637	2,440	0,111

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	5,542	5	1,108	3,937	**0,01198**	2,711
Columns	7,363	4	1,841	6,539	**0,00156**	2,866
Error	5,630	20	0,282			
Total	18,535	29				

The Marital Status

The results of ANOVA are summed up in the tables **Tab. 6.23** and **Tab. 6.24**. In the first table, the P-value for columns is lower than 0.05 (P-value < 0.05) and F_{crit} is lower than F ($F_{crit} < F$). That stands for, that there is a difference between different marital statuses. The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The marital status of respondents does have a statistically significant effect on the perception of the noisiness of selected environmental noise source in Respondents' Local Areas in the Czech Republic.

The results from Bavaria show the opposite to that. The F-value of columns is greater than the corresponding F_{crit} value for columns ($F_{crit} > F$) and the P-value is greater than 0.05 (P-value $>$ 0.05). That means, that there is no statistically significant effect of the marital status on the perception of noise caused by selected environmental noise sources in Bavaria. The null hypothesis is not rejected in this case.

Table 6.23.: The Impact of the Respondents' Marital Status on the Perception of Noise Produced by Selected Environmental Noise Sources in the Czech Republic

Q8 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	4	9,631	2,408	0,005
Road Traffic	4	11,527	2,882	0,016
Trains	4	8,120	2,030	0,044
Aircraft	4	8,227	2,057	0,004
Wind Turbine	4	7,014	1,754	0,063
Factory	4	7,995	1,999	0,080
Single	6	13,315	2,219	0,161
Married	6	12,991	2,165	0,182
In any partner cohabitation	6	13,585	2,264	0,234
Divorced	6	12,625	2,104	0,171

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,185	5	0,637	17,303	9,32E-06	2,901
Columns	0,086	3	0,029	0,778	**0,52444**	3,287
Error	0,552	15	0,037			
Total	3,823	23				

Table 6.24.: The Impact of the Respondents' Marital Status on the Perception of Noise Produced by Selected Environmental Noise Sources in Bavaria

Q8 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	10,604	2,121	0,450
Road Traffic	5	14,445	2,889	0,014
Trains	5	12,579	2,516	0,116
Aircraft	5	12,366	2,473	0,151
Wind Turbine	5	9,318	1,864	0,452
Factory	5	10,506	2,101	0,406
Single	6	13,250	2,208	0,159
Married	6	13,485	2,247	0,175
In any partner cohabitation	6	14,084	2,347	0,159
Divorced	6	13,000	2,167	0,599
Widow	6	16,000	2,667	0,667

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,405	5	0,681	2,528	**0,06271**	2,711
Columns	0,971	4	0,243	0,901	**0,48176**	2,866
Error	5,389	20	0,269			
Total	9,765	29				

The Employment Status

As listed in table **Tab. 6.25,** the P-value of columns is greater than 0.05 (P-value $>$ 0.05), and the F-value is greater than the interrelated F_{crit} value ($F_{crit} > F$). That signifies, that there is no significant difference between individual kinds of employment status in the Czech Republic.

Table 6.25.: The Impact of the Respondents' Employment Status on the Perception of Noise Produced by Selected Environmental Noise Sources in the Czech Republic

Q8 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	9	21,902	2,434	0,095
Road Traffic	9	25,268	2,808	0,062
Trains	9	18,101	2,011	0,337
Aircraft	9	18,584	2,065	0,142
Wind Turbine	9	15,228	1,692	0,401
Factory	9	18,716	2,080	0,336
Employee	6	13,248	2,208	0,173
Student	6	13,513	2,252	0,161
Self-empl., Freelancer, Private farmer	6	12,954	2,159	0,285
The owner of a company with empl.	6	12,750	2,125	0,219
Housewife	6	13,300	2,217	0,346
Working pensioner	6	10,500	1,750	0,675
Retired	6	11,867	1,978	0,554
Unemployed	6	13,333	2,222	0,296
The owner of a comp. without empl.	6	16,333	2,722	0,196

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	6,734	5	1,347	6,915	**9,81E-05**	2,449
Columns	3,194	8	0,399	2,050	**0,06471**	2,180
Error	7,791	40	0,195			
Total	17,718	53				

The P-value for columns shown in the **Tab. 6.26** is lower than 0.05 (P-value $<$ 0.05). F_{crit} is lower than F ($F_{crit} < F$). That means, that there is a significant difference between the groups of respondents with different employment status. The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The Employment Status does have a statistically significant effect on the evaluation of perception of the selected noise sources in Bavaria.

Table 6.26.: The Impact of the Respondents' Employment Status on the Perception of Noise Produced by Selected Environmental Noise Sources in Bavaria

Q8 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	6	15,163	2,527	0,240
Road Traffic	6	15,341	2,557	0,372
Trains	6	11,990	1,998	0,313
Aircraft	6	12,344	2,057	0,465
Wind Turbine	6	11,786	1,964	2,302
Factory	6	12,184	2,031	0,469
Employee	6	13,808	2,301	0,160
Student	6	12,000	2,000	0,514
Self-empl., Freelancer, Private farmer	6	17,000	2,833	1,367
The owner of a company with empl.	6	8,000	1,333	0,267
Housewife	6	12,000	2,000	0,090
Working pensioner	6	16,000	2,667	0,467

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	2,273	5	0,455	0,944	**0,47037**	2,603
Columns	8,757	5	1,751	3,635	**0,01312**	2,603
Error	12,045	25	0,482			
Total	23,075	35				

The Satisfaction with Monthly Income

Tab. 6.27 outlines, that the F-value for columns is greater than the corresponding F_{crit} values for columns ($F_{crit} > F$) and the P-value is greater than 0.05 (P-value > 0.05). That means, that there is no significant difference between the two genders in the Czech Republic and the null hypothesis is not rejected.

Tab. 6.28 indicates, that the P-value for columns is less than 0.05 (P-value < 0.05), and F_{crit} is less than F ($F_{crit} < F$). That shows, that there is a significant difference between the groups of respondents which are more or less satisfied with their monthly income. The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The Satisfaction with Monthly Income does have a statistically significant effect on the evaluation of perception of the selected noise sources in Bavaria.

Table 6.27.: The Impact of the Respondents' Satisfaction with Monthly Income on the Perception of Noise Produced by Selected Environmental Noise Sources in the Czech Republic

Q8 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	11,844	2,369	0,035
Road Traffic	5	14,733	2,947	0,013
Trains	5	10,364	2,073	0,012
Aircraft	5	10,198	2,040	0,002
Wind Turbine	5	7,964	1,593	0,036
Factory	5	10,714	2,143	0,012
Very dissatisfied	6	13,333	2,222	0,302
Dissatisfied	6	13,118	2,186	0,270
Quite satisfied	6	12,720	2,120	0,196
Satisfied	6	13,256	2,209	0,172
Very satisfied	6	13,389	2,231	0,138

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	4,998	5	1,000	51,742	**9,28E-11**	2,711
Columns	0,048	4	0,012	0,619	**0,65397**	2,866
Error	0,386	20	0,019			
Total	5,432	29				

Table 6.28.: The Impact of the Respondents' Satisfaction with Monthly Income on the Perception of Noise Produced by Selected Environmental Noise Sources in Bavaria

Q8 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	11,006	2,201	0,023
Road Traffic	5	13,236	2,647	0,074
Trains	5	10,350	2,070	0,213
Aircraft	5	10,180	2,036	0,401
Wind Turbine	5	7,252	1,450	0,085
Factory	5	9,107	1,821	0,252
Very dissatisfied	6	9,000	1,500	0,400
Dissatisfied	6	11,200	1,867	0,144
Quite satisfied	6	14,369	2,395	0,220
Satisfied	6	13,550	2,258	0,141
Very satisfied	6	13,011	2,169	0,110

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,955	5	0,791	14,076	**5,70E-06**	2,711
Columns	3,071	4	0,768	13,660	**1,59E-05**	2,866
Error	1,124	20	0,056			
Total	8,150	29				

The Size of Municipality

In the **Tab. 6.29**, the F-value of columns is greater than the corresponding F_{crit} value for columns ($F_{crit} > F$) and the P-value is greater than 0.05 (P-value > 0.05). Accordingly, it can be concluded that the null hypothesis is not rejected and the size of the municipality has no effect on the noise perception in the Czech Republic.

Table 6.29.: The Impact of the Size of Respondents' Municipality on the Perception of Noise Produced by Selected Environmental Noise Sources in the Czech Republic

Q8 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	11,809	2,362	0,071
Road Traffic	5	14,050	2,810	0,025
Trains	5	10,732	2,146	0,016
Aircraft	5	10,404	2,081	0,008
Wind Turbine	5	8,443	1,689	0,051
Factory	5	10,345	2,069	0,036
Up to 999 inhabitants	6	12,640	2,107	0,122
1000 - 4999 inhabitants	6	13,149	2,191	0,192
5000 - 19 999 inhabitants	6	13,300	2,217	0,189
20 000 - 99 999 inhabitants	6	13,290	2,215	0,121
100 000 and more inhabitants	6	13,403	2,234	0,225

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,469	5	0,694	18,006	**8,52E-07**	2,711
Columns	0,061	4	0,015	0,396	**0,80935**	2,866
Error	0,771	20	0,039			
Total	4,300	29				

The P-value for columns in the **Tab. 6.30** is lower than 0.05 (P-value < 0.05), and F_{crit} is lower than F ($F_{crit} < F$). This signifies, that there is a significant impact of the size of respondents' municipality on the perception of noise produced by selected sources in Bavaria. The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The Size of Respondents' Municipality does have a statistically significant effect on the evaluation of perception of the selected noise sources in Bavaria.

Table 6.30.: The Impact of the Size of Respondents' Municipality on the Perception of Noise Produced by Selected Environmental Noise Sources in Bavaria

Q8 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	11,576	2,315	0,098
Road Traffic	5	14,317	2,863	0,228
Trains	5	11,633	2,327	0,021
Aircraft	5	11,470	2,294	0,120
Wind Turbine	5	8,106	1,621	0,079
Factory	5	10,373	2,075	0,093
Up to 999 inhabitants	6	11,500	1,917	0,090
1000 - 4999 inhabitants	6	13,795	2,299	0,081
5000 - 19 999 inhabitants	6	14,684	2,447	0,264
20 000 - 99 999 inhabitants	6	13,057	2,176	0,151
100 000 and more inhabitants	6	14,439	2,407	0,521

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	4,073	5	0,815	11,171	**3,05E-05**	2,711
Columns	1,095	4	0,274	3,753	**1,96E-02**	2,866
Error	1,458	20	0,073			
Total	6,626	29				

Conclusions:

The results of the analysis of variance ascertained, that only the level of education has a statistically significant effect on the evaluation of perception selected noise sources in both countries. On the other hand, gender has no statistically significant effect on the respondents' perception of selected environmental noise sources. The analysis of variance did not produce clear results by other monitored groups.

In the Czech Republic, there was a significant effect of age, and marital status on the noise perception, but in Bavaria, there was the result the opposite, and there was no influence of these two monitored groups on the noise perception.

The employment status, the satisfaction with monthly income, and the size of respondents' municipalities influenced the perception of different noise sources in Bavaria but not in the Czech Republic.

Except for two cases above, the P-value of rows was lower than 0.05 (P-value < 0.05) and also F_{crit} was lower than corresponding F ($F_{crit} < F$). Consequently, it was confirmed, that there was a significant difference between evaluation of individual noise sources. The null hypothesis is

rejected and the alternative hypothesis is accepted.

H_1: The type of environmental noise source does have a significant effect on the perception of noisiness in Respondents' Local Areas.

6.4.3. Assessment of Noise Nuisance from Selected Environmental Noise Sources over the Last 12 Months in Respondents' Local Areas.

The data analyzed in this subsection were obtained from the answers to the question Q12. This subsection deals with the assessment of noise nuisance from the same six selected environmental noise sources as previously stated within the last 12 months in a place where the survey participants dwell. The two-factor analysis of variance was used to analyze the influence of the above-mentioned monitored groups again. Null and alternative hypotheses are defined below.

Null hypotheses:

H_0: The monitored group to which a respondent belongs, will have no statistically significant effect on the assessment of noise nuisance from selected environmental noise sources over the last 12 months in respondents' local areas.

H_0: The type of environmental noise source will have no significant effect on the assessment of noise nuisance from selected environmental noise sources over the last 12 months in respondents' local areas.

Alternative hypotheses:

H_1: The monitored group to which a respondent belongs, does have a statistically significant effect on the assessment of noise nuisance from selected environmental noise sources over the last 12 months in respondents' local areas.

H_1: The type of environmental noise source does have a significant effect on the assessment of noise nuisance from selected environmental noise sources over the last 12 months in respondents' local areas.

The Gender of Respondents

In the **Tables 6.31** and **6.32**, the F-values of columns are greater than the corresponding F_{crit} values ($F_{crit} > F$), and the P-value are greater than 0.05 (P-Value > 0.05). That implies, that there is no significant difference between the two genders in both countries and the null hypothesis is not rejected.

Table 6.31.: The Impact of Respondents' Gender on the Assessment of the Noise Nuisance from Selected Environmental Noise Sources within the Last 12 Months in Respondent's Areas in the Czech Republic

Q12 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	2	3,937	1,969	0,006
Road Traffic	2	4,181	2,090	0,001
Trains	2	2,570	1,285	0,000
Aircraft	2	2,503	1,251	0,000
Wind Turbine	2	2,159	1,080	0,002
Factory	2	2,867	1,434	0,002
Male	6	9	1,507	0,152
Female	6	9	1,529	0,192

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,710	5	0,342	183,512	**1,17E-05**	5,050
Columns	0,002	1	0,002	0,829	**0,40444**	6,608
Error	0,009	5	0,002			
Total	1,721	11				

Table 6.32.: The Impact of Respondents' Gender on the Assessment of the Noise Nuisance from Selected Environmental Noise Sources within the Last 12 Months in Respondent's Areas in Bavaria

Q12 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	2	3,896	1,948	0,044
Road Traffic	2	4,364	2,182	0,005
Trains	2	3,203	1,602	0,016
Aircraft	2	2,881	1,440	0,003
Wind Turbine	2	2,107	1,054	0,000
Factory	2	2,798	1,399	0,000
Male	6	10	1,654	0,202
Female	6	9	1,554	0,136

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,648	5	0,330	42,387	**0,00043**	5,050
Columns	0,030	1	0,030	3,874	**0,10618**	6,608
Error	0,039	5	0,008			
Total	1,717	11				

The Age of Respondents

Table 6.33.: The Impact of Respondents' Age on the Assessment of the Noise Nuisance from Selected Noise Sources within the Last 12 Months in Respondent's Areas in the Czech Rep.

Q12 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	2	3,782	1,891	0,019
Road Traffic	2	4,146	2,073	0,001
Trains	2	2,570	1,285	0,001
Aircraft	2	2,516	1,258	0,002
Wind Turbine	2	2,253	1,126	0,006
Factory	2	2,771	1,385	0,013
<= 30 years old	6	9,110	1,518	0,166
> 30 years old	6	8,928	1,488	0,137

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	1,477	5	0,295	38,000	**0,00056**	5,050
Columns	0,003	1	0,003	0,355	**0,57701**	6,608
Error	0,039	5	0,008			
Total	1,519	11				

Table 6.34.: The Impact of Respondents' Age on the Assessment of the Noise Nuisance from Selected Noise Sources within the Last 12 Months in Respondent's Areas in Bavaria

Q12 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	2	4,143	2,071	0,174
Road Traffic	2	4,582	2,291	0,152
Trains	2	3,175	1,588	0,006
Aircraft	2	2,734	1,367	0,080
Wind Turbine	2	2,153	1,077	0,008
Factory	2	2,872	1,436	0,019
<= 30 years old	6	10	1,717	0,370
>30 years old	6	9	1,559	0,121

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	2,092	5	0,418	5,750	**0,03883**	5,050
Columns	0,075	1	0,075	1,036	**0,35552**	6,608
Error	0,364	5	0,073			
Total	2,531	11				

As in the previous case, the **Tab. 6.33** and **6.34** depict the F-values of columns greater than the appendant F_{crit} values ($F_{crit} > F$), and the P-value greater than 0.05 (P-Value > 0.05). That means, that there is no significant influence of age groups in both countries and the null hypothesis is not rejected.

The Education Level

The results of the analysis of variance are summarized in the **Tab. 6.35** and **Tab. 6.36**. In this case, the both F-values for columns are greater than the corresponding F_{crit} values for columns ($F_{crit} > F$) and the P-values are greater than 0.05 (P-value > 0.05). That signifies, that there is no significant impact of the education level in both countries and the null hypothesis is not rejected.

Table 6.35.: The Impact of the Respondents' Education Level on the Assessment of the Noise Nuisance from Selected Noise Sources within the Last 12 Months in Respondent's Areas in the Czech Republic

Q12 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	9,417	1,883	0,065
Road Traffic	5	10,055	2,011	0,006
Trains	5	6,413	1,283	0,013
Aircraft	5	6,167	1,233	0,002
Wind Turbine	5	6,252	1,250	0,046
Factory	5	6,675	1,335	0,036
Basic education	6	9,286	1,548	0,135
Sec. ed. with app. certificate	6	8,636	1,439	0,077
Sec. ed. with Matura exam	6	9,014	1,502	0,191
Higher professional education	6	9,000	1,500	0,192
Higher ed./ University degree	6	9,043	1,507	0,149

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,080	5	0,616	19,294	**4,90E-07**	2,711
Columns	0,036	4	0,009	0,282	**0,88636**	2,866
Error	0,639	20	0,032			
Total	3,754	29				

Table 6.36.: The Impact of the Respondents' Education Level on the Assessment of the Noise Nuisance from Selected Noise Sources within the Last 12 Months in Respondent's Areas in Bavaria

Q12 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	9,375	1,875	0,049
Road Traffic	5	12,425	2,485	0,810
Trains	5	10,183	2,037	1,282
Aircraft	5	6,792	1,358	0,100
Wind Turbine	5	5,122	1,024	0,001
Factory	5	6,432	1,286	0,045
Basic education	6	8,875	1,479	0,096
Sec. ed. with app. certificate	6	9,343	1,557	0,122
Sec. ed. with Matura exam	6	9,250	1,542	0,354
Higher professional ed.	6	13,000	2,167	2,167
Higher ed./ University degree	6	9,860	1,643	0,216

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	7,508	5	1,502	4,130	**0,00971**	2,711
Columns	1,876	4	0,469	1,290	**0,30725**	2,866
Error	7,271	20	0,364			
Total	16,655	29				

The Employment Status

Tab. 6.37 outlines, that the F-value for columns is greater than the corresponding F_{crit} values for columns ($F_{crit} > F$) and the P-value is greater than 0.05 (P-value > 0.05). That signifies, that there is no statistically significant impact on the assessment of the noise nuisance from selected environmental noise sources in the Czech Republic. Therefore, the null hypothesis is not rejected.

The P-value for columns in the **Tab. 6.38** is lower than 0.05 (P-value < 0.05), and F_{crit} is lower than appendant F ($F_{crit} > F$). This suggests, that there is a significant impact of the employment status on the assessment of the noise nuisance from selected environmental noise sources in Bavaria. The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The employment status does have a statistically significant effect on the assessment of noise nuisance from selected environmental noise sources over the last 12 months in respondents' local areas in Bavaria.

Table 6.37.: The Impact of Respondents' Empl. Status on the Assessment of the Noise Nuisance from Selected Noise Sources within the Last 12 Months in Respondent's Areas in the Czech Rep.

Q12 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	9	16,992	1,888	0,088
Road Traffic	9	17,848	1,983	0,162
Trains	9	11,481	1,276	0,050
Aircraft	9	11,901	1,322	0,026
Wind Turbine	9	10,684	1,187	0,209
Factory	9	13,195	1,466	0,066
Employee	6	9,113	1,519	0,163
Student	6	8,955	1,492	0,152
Self-empl., Freelancer, Private farmer	6	8,700	1,450	0,104
The owner of a company with empl.	6	9,000	1,500	0,125
Housewife	6	9,600	1,600	0,428
Working pensioner	6	9,500	1,583	0,342
Retired	6	9,567	1,594	0,251
Unemployed	6	7,333	1,222	0,030
The owner of a comp. without empl.	6	10,333	1,722	0,196

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	5,062	5	1,012	10,392	**1,94E-06**	2,449
Columns	0,909	8	0,114	1,167	**0,34255**	2,180
Error	3,897	40	0,097			
Total	9,868	53				

Table 6.38.: The Impact of Respondents' Empl. Status on the Assessment of the Noise Nuisance from Selected Noise Sources within the Last 12 Months in Respondent's Areas in Bavaria

Q12 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	6	12,121	2,020	0,528
Road Traffic	6	11,335	1,889	0,692
Trains	6	9,073	1,512	0,328
Aircraft	6	8,280	1,380	0,173
Wind Turbine	6	6,068	1,011	0,001
Factory	6	8,194	1,366	0,162
Employee	6	9,634	1,606	0,160
Student	6	10,222	1,704	0,547
Self-empl., Freelancer, Private farmer	6	7,000	1,167	0,167
The owner of a company with empl.	6	6,000	1,000	0,000
Housewife	6	8,714	1,452	0,093
Working pensioner	6	13,500	2,250	0,575

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	4,129	5	0,826	5,768	**0,00113**	2,603
Columns	5,839	5	1,168	8,157	**0,00011**	2,603
Error	3,579	25	0,143			
Total	13,548	35				

The Marital Status

In the **Tab. 6.39** and **Tab. 6.40**, the F-value of columns is greater than the corresponding F_{crit} value for columns ($F_{crit} > F$), and the P-value is greater than 0.05 (P-value > 0.05). Accordingly, it can be concluded that the marital status has no effect on the assessment of the noise nuisance from selected environmental noise sources in both countries. The null hypothesis is not rejected.

Table 6.39.: The Impact of Respondents' Marital Status on the Assessment of the Noise Nuisance from Selected Environmental Noise Sources within the Last 12 Months in Respondent's Areas in the Czech Republic

Q12 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	4	7,507	1,877	0,014
Road Traffic	4	8,302	2,076	0,023
Trains	4	5,110	1,277	0,003
Aircraft	4	5,188	1,297	0,026
Wind Turbine	4	4,891	1,223	0,075
Factory	4	5,365	1,341	0,022
Single	6	8,950	1,492	0,135
Married	6	9,291	1,549	0,179
In any partner cohabitation	6	8,873	1,479	0,208
Divorced	6	9,250	1,542	0,104

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	2,658	5	0,532	17,010	**1,04E-05**	2,901
Columns	0,022	3	0,007	0,236	**0,86967**	3,287
Error	0,469	15	0,031			
Total	3,149	23				

Table 6.40.: The Impact of Respondents' Marital Status on the Assessment of the Noise Nuisance from Selected Environmental Noise Sources within the Last 12 Months in Respondent's Areas in Bavaria

Q12 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	9,002	1,800	0,286
Road Traffic	5	10,338	2,068	0,089
Trains	5	9,493	1,899	0,399
Aircraft	5	7,862	1,572	0,065
Wind Turbine	5	5,168	1,034	0,004
Factory	5	7,290	1,458	0,139
Single	6	10,179	1,696	0,225
Married	6	9,042	1,507	0,128
In any partner cohabitation	6	10,333	1,722	0,299
Divorced	6	8,600	1,433	0,119
Widow	6	11,000	1,833	0,567

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,404	5	0,681	4,150	**0,00950**	2,711
Columns	0,646	4	0,162	0,985	**0,43818**	2,866
Error	3,280	20	0,164			
Total	7,330	29				

The Satisfaction with Monthly Income

The overview in **Tab. 6.41** and **Tab. 6.42** indicate, that there is a significant difference between the groups of respondents which are more or less satisfied with their monthly income. The P-values for columns are lower than 0.05 (P-value < 0.05), and F_{crit} is lower than corresponding F ($F_{crit} < F$). The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The satisfaction with monthly income does have a statistically significant effect on the assessment of noise nuisance from selected environmental noise sources over the last 12 months in respondents' local areas.

Table 6.41.: The Impact of Satisfaction with Monthly Income on the Assessment of the Noise Nuisance from Selected Noise Sources within the Last 12 Months in the Czech Rep.

Q12 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	9,205	1,841	0,043
Road Traffic	5	10,168	2,034	0,041
Trains	5	6,056	1,211	0,007
Aircraft	5	5,949	1,190	0,005
Wind Turbine	5	5,496	1,099	0,005
Factory	5	6,997	1,399	0,000
Very dissatisfied	6	8,922	1,487	0,163
Dissatisfied	6	9,141	1,524	0,184
Quite satisfied	6	9,041	1,507	0,152
Satisfied	6	7,833	1,306	0,077
Very satisfied	6	8,900	1,483	0,130

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	3,715	5	0,743	70,179	**5,47E-12**	2,711
Columns	0,190	4	0,047	4,479	**0,009545**	2,866
Error	0,212	20	0,011			
Total	4,116	29				

Table 6.42.: The Impact of Satisfaction with Monthly Income on the Assessment of the Noise Nuisance from Selected Noise Sources in the Last 12 Months in Respondent's Areas in Bavaria

Q12 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	2	3,896	1,948	0,044
Road Traffic	2	4,364	2,182	0,005
Trains	2	3,203	1,602	0,016
Aircraft	2	2,881	1,440	0,003
Wind Turbine	2	2,107	1,054	0,000
Factory	2	2,798	1,399	0,000
Very dissatisfied	6	9	1,417	0,242
Dissatisfied	6	10	1,632	0,201
Quite satisfied	6	10	1,735	0,176
Satisfied	6	10	1,608	0,167
Very satisfied	6	9	1,483	0,130

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	4,201	5	0,840	44,630	**3,579E-10**	2,711
Columns	0,380	4	0,095	5,042	**0,0056362**	2,866
Error	0,377	20	0,019			
Total	4,957	29				

The Size of Municipality

In the **Tab. 6.43**, there is the F-value of columns greater than the corresponding F_{crit} value for columns ($F_{crit} > F$) and the P-value is greater than 0.05 (P-value > 0.05). This concludes, that the size of a municipality has no statistically significant impact of on the assessment of the noise nuisance from selected environmental noise sources in the Czech Republic. The null hypothesis is not rejected in this case.

In contrast to that, in Bavaria appeared a significant impact on the assessment of noise nuisance from selected environmental noise sources over the last 12 months in respondents' local areas. F_{crit} for columns in the Tab. 6.43 is lower than F ($F_{crit} < F$) and the P-value is lower than 0.05 (P-value < 0.05). The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The size of a municipality does have a statistically significant effect on the assessment of noise nuisance from selected environmental noise sources over the last 12 months in respondents' local areas in Bavaria.

Table 6.43.: The Impact of the Size of a Municipality on the Assessment of the Noise Nuisance from Selected Noise Sources within the Last 12 Months in Respondent's Areas in the Czech Rep.

Q12 - Anova: Two-Factor Without Replication (Czech Republic)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	9,218	1,844	0,058
Road Traffic	5	9,987	1,997	0,023
Trains	5	6,621	1,324	0,017
Aircraft	5	6,379	1,276	0,005
Wind Turbine	5	5,700	1,140	0,024
Factory	5	6,735	1,347	0,015
Up to 999 inhabitants	6	8,464	1,411	0,076
1000 - 4999 inhabitants	6	9,043	1,507	0,208
5000 - 19 999 inhabitants	6	8,754	1,459	0,096
20 000 - 99 999 inhabitants	6	9,182	1,530	0,122
100 000 and more inhabitants	6	9,197	1,533	0,196

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	2,994	5	0,599	23,941	**8,32E-08**	2,711
Columns	0,066	4	0,016	0,659	**0,62781**	2,866
Error	0,500	20	0,025			
Total	3,560	29				

Table 6.44.: The Impact of the Size of a Municipality on the Assessment of the Noise Nuisance from Selected Noise Sources within the Last 12 Months in Respondent's Areas in Bavaria

Q12 - Anova: Two-Factor Without Replication (Bavaria)

Factor	*Count*	*Sum*	*Average*	*Variance*
Neighbours	5	9,483	1,897	0,154
Road Traffic	5	11,321	2,264	0,167
Trains	5	8,205	1,641	0,058
Aircraft	5	7,368	1,474	0,044
Wind Turbine	5	5,344	1,069	0,011
Factory	5	7,225	1,445	0,202
Up to 999 inhabitants	6	8,700	1,450	0,179
1000 - 4999 inhabitants	6	8,125	1,354	0,078
5000 - 19 999 inhabitants	6	10,912	1,819	0,210
20 000 - 99 999 inhabitants	6	9,708	1,618	0,254
100 000 and more inhabitants	6	11,500	1,917	0,364

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-Value*	*F crit*
Rows	4,235	5	0,847	14,264	**5,16E-06**	2,711
Columns	1,358	4	0,340	5,719	**3,09E-03**	2,866
Error	1,188	20	0,059			
Total	6,781	29				

Conclusions:

From the analysis of variance results, it can be concluded that gender, age, the level of education, and marital status of the respondents have no statistically significant effect on the noise nuisance from selected environmental noises perceived within the last 12 months in respondents' areas in the Czech Republic and Bavaria.

In the Czech Republic, the employment status, and the size of respondents' municipality have no significant impact on the perception of noise nuisance within the last year, while in Bavaria this impact is statistically significant.

The respondents' satisfaction with monthly income affects the responses in a statistically significant way in both countries.

In all cases examined in this sub-section, F_{crit} of rows was less than corresponding F ($F_{crit} < F$), and also the P-value of rows was less than 0.05 (P-value < 0.05). Therefore, it was stated, that there was a significant difference between evaluation of individual environmental noise sources. The null hypothesis is rejected and the alternative hypothesis is accepted.

H_1: The type of environmental noise source does have a statistically significant effect on the assessment of noise nuisance from selected environmental noise sources over the last 12 months in respondents' local areas.

6.4.4. Assessing the Noise Level in Respondents' Local Areas

The data analyzed in this sub-section were acquired from the answers to question Q9, which deals with the evaluation of total noisiness of the place, where the respondents live.

The noisiness was evaluated on the scale from "1 - not at all noisy" to "5 - extremely noisy", which means that the outcome is ordinal. Every monitored group of respondents consists of multiple categories. Therefore, the Spearman's correlation analysis was used to determine a relationship between the monitored groups and assessing the noise level in respondents' local areas. Besides, the correlation of respondents' comfort issues and the evaluation of the noise level was explored.

These hypotheses were established for all the monitored groups and health and comfort issues.

Null hypotheses:

H_0: There is no significant relationship between the monitored group to which a respondent belongs and the assessment of noise level in respondents' local areas. (H_0: $\rho = 0$)

H_0: There is no significant relationship between health and comfort of the respondents and the assessment of noise level in respondents' local areas. (H_0: $\rho = 0$)

Alternative hypothesis:

H_1: There will be a relationship between the monitored group to which a respondent belongs and the assessment of noise level in respondents' local areas. (H_1: $\rho \neq 0$ or H_2: $\rho < 0$ or H_3: $\rho > 0$)

H_1: There will be a relationship between health and comfort of the respondents and the assessment of noise level in respondents' local areas. (H_1: $\rho \neq 0$ or H_2: $\rho < 0$ or H_3: $\rho > 0$)

In the **Tab. 6.45**, there are listed the resultant correlation coefficients and P-values. The p-value was lower than 0.05 (P-value < 0.05) and confirmed the significant relationship between the size of the municipality and the assessment of noise level in respondents' local areas. However, the correlation is weak. In larger cities is reported a higher level of noise.

Very weak and marginally significant correlation appeared by gender. Women complain about the noise level slightly more than men.

Health and comfort issues of respondents have more significant relationships with the assessment of the noise level. The p-values of the statements on how healthy the participants feel at the moment, how noisy the place where they fulfilled the questionnaire was, and the quality of

Table 6.45.: The Relationships between Monitored Groups or Health and Comfort of the Respondents with the Assessment of the Noise Level in Respondent's Areas.

Q9 - Spearman's Rank Correlation

Socio-economic groups	*rho*	*p-value*
Gender	**0,104**	**0,050**
Age	-0,036	0,492
Education Level	-0,061	0,251
Marital Status	0,029	0,581
Employment Status	-0,025	0,639
Satisfaction with Monthly Income	0,064	0,227
Size of Municipality	**0,201**	**0,000**

Health and comfort issues	*rho*	*p-value*
Health	**-0,185**	**0,000**
Noise	**-0,318**	**0,000**
Temperature	-0,064	0,225
Air Quality	**-0,213**	**0,000**
Sensitivity to Noise	-0,035	0,504

air in that place are strongly below 0.05 (P-value $<$ 0.05). That conveys a very significant relationship of this issues with the assessment of noise level. The "rho" of health suggest a very weak anti-correlation. The "rho" of noise and the air quality a weak anti-correlation. The worse the survey participants feel in terms of health, noise or air quality, the more annoying the environmental noise is for them and vice versa.

6.4.5. Assessment of the Noise Annoyance in Respondents' Local Areas

The data gathered by Question Q13 were analyzed using Spearman's rank correlation. This analysis investigated a relationship between assessing of noise annoyance and the aforementioned monitored groups. In addition, the correlation analysis also interrogated the relationship between respondents' health and a feeling of comfort. For assessment of the annoyance in respondents' homes was used a scale from "1 - not at all annoying" to "5 - extremely annoying", The following hypotheses were established for all the monitored groups and health and comfort issues.

Null hypotheses:

H_0: There is no significant relationship between the monitored group to which the re-

spondent belongs and the assessment of noise annoyance in respondents' local areas. (H_0: $\rho = 0$)

H_0: There is no significant relationship between health and comfort of the respondents and the assessment of noise annoyance in respondents' local areas. (H_0: $\rho = 0$)

Alternative hypothesis:

H_1: There will be a relationship between the monitored group to which the respondent belongs and the assessment of noise annoyance in respondents' local areas. (H_1: $\rho \neq 0$ or H_2: $\rho < 0$ or H_3: $\rho > 0$)

H_1: There will be a relationship between health and comfort of the respondents and the assessment of noise annoyance in respondents' local areas. (H_1: $\rho \neq 0$ or H_2: $\rho < 0$ or H_3: $\rho > 0$)

The results of Spearman's correlation are summarized in the **Tab. 6.46**. The P-value of the size of the municipality was lower than 0.05 (P-value < 0.05). That means, that there is a significant relationship. The rho is equal 0,128 what signifies, that this positive correlation is very weak. No significant relationships were observed in the other monitored groups.

The p-values of health, noise and the air quality are less than 0.05 (P-value < 0.05). That means, there is a very significant relationship of this issues with the level of annoyance. The correlation coefficient of health and noise implied a weak anti-correlation and the air quality very weak anti-correlation. Very weak and marginally significant anti-correlation was observed also by sensitivity to noise.

Conclusions

Using one-way ANOVA to determine whether there is a statistically significant effect of monitored groups on the assessment of noise level in Respondents' Local Areas gave similar conclusions as for the correlation in this case. There was no statistically significant influence in the monitored groups. Only the size of the municipality in Bavaria had a significant influence by Q13 and very significant influence by Q9. The marital status had a marginal influence on the assessment of noise annoyance in the Czech Republic. The age showed a significant effect on the perceived noise level in Bavaria.

There is a strong ($\rho = 0.733$) and super-significant (P-value = 0.000) correlation between the answers to questions Q9 and Q13, so predictors that proved to be significant in relation to 9 will be significant in relation to 13 and vice versa.

Table 6.46.: The Relationships between Monitored Groups or Health and Comfort of the Respondents with the Assessment of the Noise Annoyance in Respondent's Areas.

Q13 - Spearman's Rank Correlation

Socio-economic groups	*rho*	*p-value*
Gender	0,088	0,093
Age	0,059	0,264
Education Level	-0,019	0,725
Marital Status	0,048	0,364
Employment Status	0,024	0,651
Satisfaction with Monthly Income	0,051	0,335
Size of Municipality	**0,128**	**0,020**

Health and comfort issues	*rho*	*p-value*
Health	**-0,233**	**0,000**
Noise	**-0,348**	**0,000**
Temperature	-0,072	0,169
Air Quality	**-0,150**	**0,000**
Sensitivity to Noise	-0,035	0,004

The relationship between nationality of the respondents and total annoyance by noise at the place, where the respondents live appeared to be significant (P-value = 0.037), but the anti-correlation is very weak (ρ = -0.110). Basically, this means, that the Czech participants complain a bit more about the noise annoyance than the Bavarian participants. In Bavaria, there was a larger group of respondents living in smaller municipalities than in the Czech Republic. The analysis also showed that the people coming from municipalities with more inhabitants complain usually more than people from smaller municipalities. Accordingly, can be stated that the annoyance by environmental noise is perceived in both countries similarly. The analysis of question Q9 showed no significant relationship between nationality and assessing of the noise level.

6.4.6. Assessing the Interdependence of Noise Issues

The Spearman's Rank Correlation was used to evaluate relationships between questions Q7, Q8, and Q12. The results of this analysis confirm the consistency of the participants' responses.

The correlation between noticing a noise source, assessing the noisiness of the appendant noise source or evaluation of the noisiness caused by this noise source is super-significant (P-value = 0.000) in all cases. A part of the results is summarized in the **Tab. 6.47.**

Table 6.47.: The Relationships between Noticing Noise Sources (Q7), Assessing the Noisiness of the Noise Sources (Q8), and Annoyance Caused by Noise Sources within the Last 12 Months (Q12)

Spearman's Rank Correlation

Noise Source	Q7 x Q8		Q7 x Q12		Q8 x Q12	
	rho	*p-value*	*rho*	*p-value*	*rho*	*p-value*
Neighbours	0,598	0,000	0,593	0,000	0,651	0,000
Road Traffic	0,531	0,000	0,669	0,000	0,613	0,000
Trains	0,349	0,000	0,614	0,000	0,411	0,000
Aircraft	0,402	0,000	0,533	0,000	0,416	0,000
Wind Turbine	0,140	0,000	0,466	0,000	0,220	0,000
Factory	0,366	0,000	0,607	0,000	0,487	0,000

The strongest correlation appeared by the combination of questions Q7 and Q12. Moreover, this strong correlation involves all of the examined noise sources. This relationship between the two questions confirms that if someone notices a noise source, this noise source is also assessed as more annoying.

A strong correlation is present also by evaluating of questions Q8 and Q12 for the road traffic noise. This means that if someone considers the road traffic noise, he would also assess the road traffic noise as more annoying.

The correlations of questions evaluating the wind turbine noise are weaker than the correlations of other noise sources. This may be caused by obtaining a small number of responses from respondents who have an experience with this noise source. A majority of all survey participants rated wind power plants as not too noisy or annoying or did not evaluate this source of noise at all due to lack of experience.

Between assessment of annoyance by road traffic noise and assessment of total noise annoyance in respondents' local areas occurred very significant (P-value = 0.000) and moderately strong correlation ($\rho = 0.534$), as well as between noisiness of road traffic and total noisiness ($\rho = 0.378$). This confirms that road traffic noise plays a significant role in assessing the overall noise of the site.

The noisiness of trains, aircraft and wind turbines shows no significant correlation with total noisiness of total annoyance in respondents' local areas.

Relationships between Selected Environmental Noise Sources

In this sub-section, there was investigated a relationship between those who are more likely to notice one environmental noise source and those who are more likely to observe another type of noise.

A further interaction was expected by assessing the noisiness of selected environmental noise sources in respondents' local areas.

Another considered relationship was between those who are annoyed by the selected environmental noise from one source and could be annoyed by the noise from another source. Following hypotheses were set for all of the three issues.

Null hypotheses:

H_0: There is no significant relationship between noticing selected environmental noise source in respondents' local areas and noticing another environmental noise source in respondents' local areas. (H_0: $\rho = 0$)

H_0: There is no significant relationship between the perception of the noisiness of selected environmental noise source in respondents' local areas, and the perception of the noisiness of another environmental noise source in respondents' local areas. (H_0: $\rho = 0$)

H_0: There is no significant relationship between the assessment of annoyance by a selected environmental noise source in respondents' local areas, and the assessment of annoyance by another environmental noise source in respondents' local areas within the last 12 months. (H_0: $\rho = 0$)

Alternative hypothesis:

H_1: There will be a relationship between noticing selected environmental noise source in respondents' local areas and noticing another environmental noise source in respondents' local areas. (H_1: $\rho \neq 0$ or H_2: $\rho < 0$ or H_3: $\rho > 0$)

H_1: There will be a relationship between the perception of the noisiness of selected environmental noise source in respondents' local areas and the perception of the noisiness of another environmental noise source in respondents' local areas. (H_1: $\rho \neq 0$ or H_2: $\rho < 0$ or H_3: $\rho > 0$)

H_1: There will be a relationship between the assessment of annoyance by a selected environmental noise source in respondents' local areas, and the assessment of annoyance

by another environmental noise source in respondents' local areas within the last 12 months. (H_1: $\rho \neq 0$ or H_2: $\rho < 0$ or H_3: $\rho > 0$)

The overview of the correlation results is depicted in the **Tab.** 6.48, **Tab. 6.49** and **Tab. 6.50.**

In terms of noticing a particular noise source when another noise source is noticed, the relationship is significant between the noise caused by a factory or a construction and all of the other noise sources. However, the correlation is very weak in this case. The very significant relationship appeared between aircraft noise and railway noise, and between road traffic noise and the noise caused by neighbors. Further significant relationships are between trains and neighbors, and road traffic and aircraft. All of the correlations are very weak.

Considering the perception of the noisiness of particular environmental noise sources, the relationships were very significant (P-value = 0.000) and some correlations were also strong. A strong correlation exists between aircraft and trains, wind turbine, and a factory or construction. Only not significant relationship appeared between neighbors and the wind turbine as sources of the environmental noise.

The survey participants who are bothered by one type of the noise source also tend to be annoyed by another environmental noise source. All of the links between particular noise sources are significant, However, the correlations are weak in all of the cases.

Table 6.48.: The Relationships between Particular Noise Sources (Q7).

Q7 - Spearman's Rank Correlation

Noise Source	Neighbors		Road Traffic		Trains		Aircraft		Wind Turbine		Factory	
	rho	***p-val.***	***rho***	***p-val.***	***rho***	***p-val.***	***rho***	***p-val.***	***rho***	***p-val.***	***rho***	***p-val.***
Neighbors			0,190	0,000	0,132	0,012	0,083	0,113	-0,043	0,365	0,141	0,007
Road Traffic	0,190	0,000			0,096	0,060	0,136	0,009	0,018	0,737	0,155	0,003
Trains	0,132	0,012	0,096	0,060			0,260	0,000	0,067	0,203	0,140	0,008
Aircraft	0,083	0,113	0,136	0,009	0,260	0,000			0,085	0,105	0,217	0,000
Wind Turbine	-0,043	0,365	0,018	0,737	0,067	0,203	0,085	0,105			0,124	0,018
Factory	0,141	0,007	0,155	0,003	0,140	0,008	0,217	0,000	0,124	0,018		

Table 6.49.: The Relationships between Particular Noise Sources (Q8).

Q8 - Spearman's Rank Correlation

Noise Source	Neighbors		Road Traffic		Trains		Aircraft		Wind Turbine		Factory	
	rho	*p-val.*	*rho*	*p-val.*	*rho*	*p-val.*	*rho*	*p-val.*	*rho*	*p-val.*	*rho*	*p-val.*
Neighbors			0,234	0,000	0,198	0,000	0,125	0,017	0,088	0,099	0,195	0,000
Road Traffic	0,234	0,000			0,421	0,000	0,393	0,000	0,316	0,000	0,378	0,000
Trains	0,198	0,000	0,421	0,000			0,612	0,000	0,562	0,000	0,564	0,000
Aircraft	0,125	0,017	0,393	0,000	0,612	0,000			0,626	0,000	0,618	0,000
Wind Turbine	0,088	0,099	0,316	0,000	0,562	0,000	0,626	0,000			0,630	0,000
Factory	0,195	0,000	0,378	0,000	0,564	0,000	0,618	0,000	0,630	0,000		

Table 6.50.: The Relationships between Particular Noise Sources (Q12)

Q12 - Spearman's Rank Correlation

Noise Source	Neighbors		Road Traffic		Trains		Aircraft		Wind Turbine		Factory	
	rho	*p-val.*	*rho*	*p-val.*	*rho*	*p-val.*	*rho*	*p-val.*	*rho*	*p-val.*	*rho*	*p-val.*
Neighbors			0,270	0,000	0,208	0,000	0,112	0,033	0,110	0,037	0,249	0,000
Road Traffic	0,270	0,000			0,319	0,000	0,243	0,000	0,108	0,041	0,279	0,000
Trains	0,208	0,000	0,319	0,000			0,385	0,000	0,284	0,000	0,212	0,000
Aircraft	0,112	0,033	0,243	0,000	0,385	0,000			0,219	0,000	0,243	0,000
Wind Turbine	0,110	0,037	0,108	0,041	0,284	0,000	0,219	0,000			0,249	0,000
Factory	0,249	0,000	0,279	0,000	0,212	0,000	0,243	0,000	0,249	0,000		

Part III.

Final Part

7. The Methodology of Assessing the Quality of Life and Noise Issues in the Municipalities

From available literature in the Czech Republic ensures that people often do not know much about noise and its effects on human health. Most of the people are also not very interested in what is going on in the spatial planning unless they are directly affected by a new building, a motorway or other construction. A lot of the local authorities do not give great publicity to the planned changes, which can change the noise situation in the municipality. Consequently, the inhabitants have to actively check the information themselves.

The social survey carried out in [101] determined, that people are not very informed about the problematic of wind turbines (73% of survey participants consider public poorly informed about wind turbine issues). 80% of respondents stated, that they were not allowed to influence the realization of the wind power plant. The above-mentioned thesis also confirmed benefits of wind power plant for the concerned municipality, like for instance financial support of the municipality from the wind power plant provider, repairing of the access roads to the power plant and offering new job opportunities in relation to the wind turbine.

This chapter is devoted to proposing a methodology for the municipalities. The following methodology will help, on one hand, the local authorities to encourage the interests of inhabitants to seek for information and on the other hand to get information about satisfaction with the quality of life and the noise situation in the municipality. A public opinion poll subsequently conducted by a municipality should also show its citizens the interest of its representatives in the views of citizens on the issue. This methodology could also help the groups of interests to gain relevant data on the quality of life and noise issues in the surveyed area. This methodology should also contribute to finding solutions to balance the benefits and disadvantages of a wind farm or other noise source.

The following process drawns on the experience from the two surveys described in the Practical Part of this thesis. A similar process was used in the preparation and execution of both of the previously performed experiments.

7.1. The Process of Preparation and Implementation of a Quality of Life Survey

The procedure of preparing a survey is a complex issue. The process is usually divided into five phases - define, design, progress, findings, and action. Activities important in each phase are further described in the text.

The following process, as well as the examples used in the section **7.2**, are addressed to the model municipality that solves a wind turbine issues. With some modifications, this can be used universally.

Model municipality description:

- A municipality with one installed wind power plant on their territories or in its vicinity.
- A municipality wants to build another wind power plant because its construction will bring to the municipality budget the funds that can be used for its development.
- First of all, the municipality would like to know how its inhabitants assess the quality of life and the noise situation with one installed turbine.

7.1.1. Define Phase

If a given community decides that the execution of a survey is the correct way to improve the current situation, the define phase is the first step used to gain all possible information about the (noise) problem and think about the general needs of the municipality and its inhabitants.

The following questions should be answered at the beginning of the process:

- What is the issue that we want to solve or improve?
- Why is the issue important?
- Who would benefit from the solution? (Who needs the survey results?)
- When should the issue be resolved?

7.1.2. Design Phase

After answering the above-mentioned questions and analyzing the needs of the municipality and its inhabitants, the strategy steps below should be followed to design a survey:

1. Set goals and outcomes of the survey.

2. Set the budget for the survey.
3. Appoint the team responsible for preparation and execution of the survey.
4. Prepare a questionnaire in a transparent and attractive graphical form.
    a) Prepare questions that correspond to the required outputs.
    b) Formulate questions clearly and comprehensibly.
    c) Offer clear and understandable answers.
    d) Beware of not to have an extensive questionnaire.
5. Define the time period for data collection.
    a) Decide whether the questionnaires will be completed in one day (few days), and the respondents of the survey will come to some meeting facilities.
    b) Decide whether the questionnaires will be completed in the respondents' homes in a defined time period.
6. Define the method of data collection.
    a) Decide on the online or paper form of the questionnaire.
    b) Define how the questionnaires will be distributed to the respondents.
7. Determine how many and what kind of respondents should participate in the survey.
    a) Decide on from which local areas are the answers needed.
    b) Decide what number of participants has sufficient predictive value.
    c) Determine what socio-economic groups should be in the survey represented.
8. Define the method of evaluating/analyzing data.
9. Determine the way of data presentation.
10. Define the follow-up procedures in case of expected and unexpected results of the survey.

7.1.3. Progress Phase

Before this phase really begins, it is useful to test the comprehensibility of the prepared questions and the way they are filled in first on a few independent people.

In this phase, the survey itself is carried out. The responsible persons should communicate with the respondents and collect and evaluate the survey data.

It is also important to monitor the response rate continuously. In case of need could be also sent reminder e-mails or used other defined communication media to assure the sufficient number of responses.

7.1.4. Findings Phase

Findings phase is dedicated to summarize and discuss the survey results, to create the survey report and present the results as it was stated in the design phase.

7.1.5. Action Phase

After evaluating all results and making decisions should be some actions taken e.g. to inform the inhabitants about risks, protect the inhabitants' houses with new windows, do a continuous noise measurement in affected areas, or decide about the planned wind power plant as mentioned in the model example.

7.2. Questionnaire Designed for Use in Municipalities

Creating a questionnaire that is really understandable for the respondents and pleasantly graphically processed takes a lot of time. The following subsection contains useful tips which the municipality can keep in mind by creating its own questionnaire and some examples of questions. The questionnaire should contain an explanation of the survey purpose, main questions, and demographic questions that include also a dwelling. The three main parts of a questionnaire are described below.

- **Questionnaire introduction**
  - The introduction should welcome the participants to the survey.
  - The inclusion of this part is important for the correct understanding of the purpose of carrying out the survey and introducing the organizers of the survey.
  - Explaining how the responses will be used to make a change could motivate the respondents to complete the questionnaire conscientiously.
  - This part should also contain basic information about the structure of the questionnaire and instructions how to fill in the questionnaire.
  - It is also necessary to mention if the responses are anonymous, confidential, or tracked.
- **The main part of the questionnaire**

- This part contains questions about the main theme and the questions about respondents' attitude towards the topic.
- To determine the required information, the following forms of answers can be used:
  - scales (described in the sub-section in the context of assessing the degree of annoyance 2.7.1)
  - defined options to choose
    - YES/ NO questions
    - I fully agree/ rather agree/ rather disagree/ fully disagree
  - empty spaces (the author of this thesis recommends using this option only in special cases because the evaluation of this question type is time-consuming and unnecessarily complicated)
- It is important to identify the respondents' attitude towards the topic as it may affect other responses. Examples of questions that identify the respondents' views are covered in the **Tab. 7.1**.
- Some questions should be formulated positively and some negatively as it is shown in the example. This prevents the respondent from choosing only one response, which then keeps repeating.

- **Demographic questions and the questions concerning dwelling**
  - Including this type of questions will help to reveal how different groups of inhabitants view the issues.
  - Subsequently, demographic questions provide more information for the decision whether it is necessary to focus more on one of the groups of inhabitants or whether it is possible to choose a general solution to the situation.
  - Typically, gender, age, education, marital status, employment status, and economic situation in a household are identified by these questions.
  - For better identification of noise-affected areas in the investigated area, the questions about the location (e.g. street) and the type of housing are included.

The noise diary

Another part that the author recommends to include in the questionnaire is a "noise diary" for the respondents. This part is used for recording health issues, and the perception of noise

Table 7.1.: Examples of Questions that Identify Respondents' Attitude to Wind Turbines

Please think about each statement below and indicate how much you agree with it. (If you are not sure which option to mark, please select the one that is closest to your opinion.)	**I fully agree**	**I rather agree**	**I rather disagree**	**I fully disagree**
I believe that the construction of a new wind power plant near the municipality will provide its residents financial benefits.				
I support the construction of the new wind power plant in my neighborhood.				
The new wind power plant will increase the value of my house/ apartment.				
The planned wind power plant will not affect the noise situation in my local area at all.				
The wind turbine noise is unhealthy for people living in its neighborhood.				

in relation to the current weather and the wind conditions every day for ongoing continuous measurement or else bordered time-frame. This diary contributes to identifying under what conditions the residents are most annoyed by the noise produced by the wind turbines. It also expands information about the noise propagation.

An example of a diary page is shown in the **Fig. 7.1**.

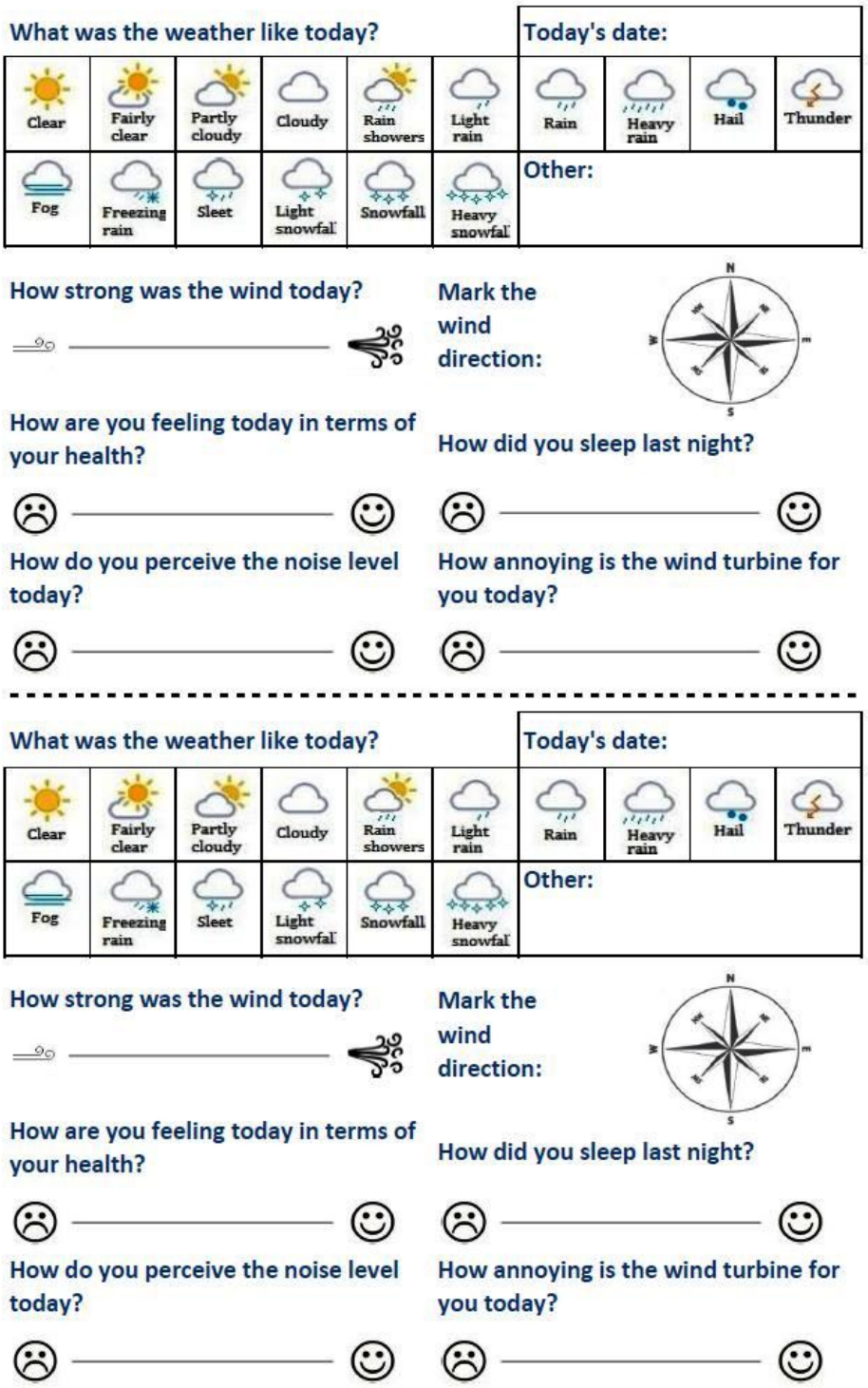

Figure 7.1.: An Example of a Page from the Noise Diary Covering the Daily Weather Conditions and Health Issues

8. Thesis Outputs

The thesis summarized the current legislation related to environmental noise in the European Union, Germany, and in the Czech Republic. The summary of the legislation is completed at the end of the theoretical part together with the summarization of noise limits in the Czech Republic.

Another contribution of this thesis is carrying out two surveys in order to map the quality of life and noise issues in the Czech Republic and in Bavaria in Germany. Conducting of this surveys helped to identify the most annoying noise sources in both countries and participants' attitude to them. In addition, the environmental noise impacts on the quality of life of people living in environmental noise-affected areas were identified and compared with other factors influencing the quality of life.

The thesis analyzed which socio-economic factors and health-related issues can influence the respondents' perception of particular environmental noise sources or the assessment of respondents' life quality.

The survey results also confirmed, that people, who live in areas without any wind turbine installation and without any experience with this kind of environmental noise source, are mostly not informed on this topic and don't consider the wind turbine noise annoying.

The last contribution of this thesis is offering a methodology for municipalities to quickly and easily determine the satisfaction of the population with the quality of life and the noise burden in the given municipality. The thesis provides a sample questionnaire and a software tool for results processing.

9. Recommendations

The proposed methodology for municipalities presented in this thesis offers the opportunity to acquire more specific data from areas affected by particular environmental noise, more precisely by the wind turbine noise. The analysis of data gathered using this questionnaire shall provide a better understanding how the wind turbine noise affects the quality of life compared to other sources of environmental noise. The data collected by "Noise Diary" will be useful to identify under what conditions the residents are most annoyed by the noise produced by the wind turbines or other noise sources. If the respondents fill at least the approximate location of the residence, the diary will also contribute to getting information about the noise propagation depending on meteorological conditions in given area.

During exchanging information with the groups objecting noise caused by wind turbine for purposes of the doctoral thesis appeared another promising direction of further research of wind turbine noise measurement. The Czech National Standard "CSN EN 61400-11" does not allow noise measurement under special weather conditions, but due to this conditions perceive inhabitants increased noise. Therefore, investigating these conditions and preparing a change proposal for standards related to wind turbine measurement can be recommended. [102]

10. Summary

The objective of this thesis was the perception of environmental noise from different sources. This thesis is divided into three main parts, more precisely into the Theoretical part, Practical part and Final part. The thesis also contains four annexes - Annex A, B, C, and D, which are devoted to the two surveys prepared with the purpose of doctoral thesis.

In the beginning, the author introduces the problem by giving the thesis background. The theoretical part offers the basic terms and environmental noise descriptors used for the noise assessment. In addition, the noise generation by different environmental noise sources is introduced in the text. The noise impacts, including the impact of noise on human health and well-being, are briefly described in this part. One of the subsections is particularly dedicated to the noise annoyance. This part also characterizes socioeconomic issues affecting environmental noise perception. In this part, there is also the role of aviation and road and rail traffic mentioned. In the last section of the theoretical part is an overview of European, German, and Czech legislation related to environmental noise.

The focus of the practical part of this doctoral thesis is the investigation of environmental noise perception, assessment of noise annoyance and the views on the quality of life in selected areas. In this part, the methodology and results of two surveys accomplished in the Czech Republic and Bavaria in Germany are presented. A summary of the important results of both surveys is already included in the experimental part. Therefore, a very brief summary of the conclusions follows.

The three most important factors influencing the quality of life in the Czech Republic and Bavaria are access to green spaces or countryside, quality of air and feelings of personal safety. Also, road traffic noise was highly important for 70% of the respondents. The analysis showed that the proportions of satisfaction as well as importance with the level of road traffic, aircraft or wind turbine noise varied by area.

As the most noticed noise, the noisiest and most annoying. in the Czech Republic as well as in Bavaria was considered the road traffic noise, followed by motorbikes and mopeds. The road traffic noise disturbs people mainly by their social life and relaxing in the garden, sleeping, and activities which need the concentration such as reading or writing.

Selected issues were further investigated with the analysis of variance and correlation analysis. This analysis determined that people coming from municipalities with more inhabitants complain

usually more than people from smaller municipalities. Women complain about noise slightly more than men, and Czech respondents complain slightly more than Bavarian respondents. The difference in results between both countries may also be caused by the different demographic profile of survey participants. About 50% of the respondents from the Czech Republic live in municipalities with more than 100,000 inhabitants, while those from Bavaria live in smaller municipalities.

Health and comfort issues of respondents have a significant relationship with the assessment of the noise level, annoyance by noise and noticing a noise source in respondents' local areas. The worse the people feel in terms of health, noise or air quality, the more annoying the environmental noise is for them and vice versa. As was expected, the temperature in the room where people filled in the questionnaires did not have any influence on the assessment of noise issues.

A relationship between those who are more likely to notice one environmental noise source and those who are more likely to observe another noise was also considered during the analysis. This relationship was also confirmed in some noise sources. The annoyance by selected noise sources and assessing of their noisiness have a stronger correlation than their noticing by respondents. The relationships appear for instance by these noise sources: road traffic, aircraft, trains, factory, neighbors, and also wind turbine. Additional details to the both surveys could be found in a technical report.

Based on experience with the compiling and evaluating the questionnaire regarding the quality of life and the perception of noise in the Czech Republic and Bavaria, a methodology for municipalities to determine the satisfaction of the population with the quality of life and the noise burden in the given municipality was prepared. Furthermore, the methodology describes a process of conducting a quality of life survey focused on wind turbine noise issues. The methodology concludes examples of questions for the questionnaire survey.

The List of Author's Publications

Publications related to the dissertation

- KABEŠOVÁ, Z., *Možnosti měření hluku v mimopracovním prostředí*, In Elektrotechnika a informatika 2010, část první: Elektrotechnika, Plzeň: Západočeská univerzita v Plzni, 37-40, ISBN 978-80-7043-913-5
- KABEŠOVÁ, Z., *Hluk ze silniční dopravy*, conference proceedings Elektrotechnika a informatika 2011, část první: Elektrotechnika, Plzeň: Západočeská univerzita v Plzni, 39-42, ISBN 978-80-261-0016-4
- KABEŠOVÁ, Z., *Aircraft Noise*, conference proceedings Elektrotechnika a informatika 2013, část první: Elektrotechnika, Plzeň: Západočeská univerzita v Plzni, 57-60, ISBN 978-80-261-0233-5
- KABEŠOVÁ, Z., *Wind Turbines and Noise Problems*, conference proceedings MMK 2013 - International Masaryk Scientific Conference for Ph.D. students and young researchers 2013, ISBN 978-80-87952-009
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Appendix

A. Questionnaire for The Czech Republic

DOTAZNÍK KVALITA ŽIVOTA

Toto dotazníkové šetření bylo připraveno za účelem sběru dat pro doktorskou disertační práci (na Fakultě elektrotechnické Západočeské univerzity v Plzni) zabývající se hlukem a jeho působením na lidské zdraví a psychiku.

Organizátorka dotazníkového šetření (Ing. Zuzana Kabešová) potvrzuje, že veškeré odpovědi budou anonymně použity jen pro vědecké účely a nebudou poskytnuty třetí straně.

Dotazník je rozdělen na 4 části - část 1 (6 otázek) je věnována spokojenosti s Vaším bydlením, část 2 (9 otázek) je věnovaná hluku ve Vašem okolí, část 3 (5 otázek) zkoumá Vaše aktuální naladění a poslední 4. část obsahuje demografické otázky.

Některé otázky je možné přeskočit, pokud se Vás téma netýká - nápověda k přeskočení je uvedena vždy před příslušnou otázkou a je označena barevně.

Pokuste se prosím odpovědět na všechny otázky.

Vyplnění celého dotazníku trvá 15 - 25 minut.

ČÁST 1

První sadou otázek bych se Vás ráda zeptala na oblast, ve které v současné době žijete, a co si myslíte o kvalitě života v této oblasti.

O1 Napište prosím, ve kterém městě bydlíte a ulici.	Město	Ulice
O2 Jak dlouho bydlíte na současné adrese?	Roky	Měsíce
O2a Jestliže jste se sem přestěhoval(a) odjinud, kde jste bydlel(a) předtím?	Město	Ulice
O2b Jestliže jste se sem přestěhoval(a) odjinud, kdy to bylo?	Rok	

Na otázku O3 odpovídejte jen v případě, že jste se do místa současného bydliště přistěhovali odjinud. Jestliže jste žili v této oblasti odjakživa, můžete přejít rovnou k otázce O4.

O3 Co bylo důvodem pro přestěhování se do současného bydliště? Pro každý z důvodů vypsaných níže, zakroužkujte jednu z možností, jak důležitý pro vás tento důvod byl k přestěhování se. *(Zakroužkujte 1 číslo v každém řádku.)*	Extrémně důležitý důvod	Velmi důležitý důvod	Středně důležitý důvod	Nepříliš důležitý důvod	Zcela nedůležitý důvod
Vzdálenost do práce	1	2	3	4	4
Vzdálenost do školy	1	2	3	4	4
Cenově dostupné bydlení	1	2	3	4	4
Kvalita bydlení	1	2	3	4	4
Kvalita okolí bydliště	1	2	3	4	4
Jiné *(Prosím, vypište)*	1	2	3	4	4

DOTAZNÍK KVALITA ŽIVOTA

O4 Zvažoval(a) jste v poslední době, že se odtud odstěhujete? *(Pokud NE, přejděte k otázce O5)*	ANO	1
	NE	2
O4a Jestliže ano, proč? *(Prosím, vypište)*		
O4b Co by Vás přimělo přes uvedené důvody zůstat? *(Prosím, vypište)*		

O5 Prosím zaznamenejte, jak důležité jsou pro Vás a Vaši domácnost níže uvedené faktory, které mohou ovlivnit kvalitu vašeho života. *(Prosím, zakroužkujte 1 číslo v každém řádku.)*	Extrémně důležité	Velmi důležité	Středně důležité	Nepříliš důležité	Zcela nedůležité
Čistota ulice	1	2	3	4	5
Kvalita místní školy	1	2	3	4	5
Objem silniční dopravy ve Vaší oblasti	1	2	3	4	5
Hluk ze silniční dopravy	1	2	3	4	5
Kvalita ovzduší	1	2	3	4	5
Hluk z letecké dopravy	1	2	3	4	5
Stav silnic a chodníků	1	2	3	4	5
Dostupnost místních rekreačních zařízení	1	2	3	4	5
Dostupnost místního praktického lékaře	1	2	3	4	5
Úroveň místní kriminality	1	2	3	4	5
Dostupnost místních obchodů	1	2	3	4	5
Pocit osobní bezpečnosti	1	2	3	4	5
Hluk z větrné elektrárny	1	2	3	4	5
Dostupnost veřejné dopravy	1	2	3	4	5
Dostupnost zaměstnání	1	2	3	4	5
Přístup k zeleným plochám / přírodě	1	2	3	4	5
Jiný *(Prosím, vypište):*	1	2	3	4	5

DOTAZNÍK KVALITA ŽIVOTA

O6 Nyní, prosím, označte, jak jste s každým níže uvedeným prvkem kvality života spokojen(á) v místě bydliště. *(Prosím, zakroužkujte 1 číslo v každém řádku.)*	Velmi spokojeni	Spokojeni	Ani spokojeni ani nespokojeni	Nespokojeni	Velmi nespokojeni
Čistota ulice	1	2	3	4	5
Kvalita místní školy	1	2	3	4	5
Objem silniční dopravy ve Vaší oblasti	1	2	3	4	5
Hluk ze silniční dopravy	1	2	3	4	5
Kvalita ovzduší	1	2	3	4	5
Hluk z letecké dopravy	1	2	3	4	5
Stav silnic a chodníků	1	2	3	4	5
Dostupnost místních rekreačních zařízení	1	2	3	4	5
Dostupnost místního praktického lékaře	1	2	3	4	5
Úroveň místní kriminality	1	2	3	4	5
Dostupnost místních obchodů	1	2	3	4	5
Pocit osobní bezpečnosti	1	2	3	4	5
Hluk z větrné elektrárny	1	2	3	4	5
Dostupnost veřejné dopravy	1	2	3	4	5
Dostupnost zaměstnání	1	2	3	4	5
Přístup k zeleným plochám / přírodě	1	2	3	4	5
Jiné *(Prosím, vypište):*	1	2	3	4	5

ČÁST 2 *Druhou sadou otázek bych se ráda dozvěděla více o hluku ve Vašem okolí.*

O7 Když jste doma, jak často zaznamenáte hluk z následujících zdrojů: *(Zakroužkujte 1 číslo v každém řádku.)*	Nikdy	Zřídka	Někdy	Často	Neustále
Zabezpečení domů a autoalarmy	1	2	3	4	5
Sousedé	1	2	3	4	5
Psí štěkání	1	2	3	4	5
Hrající si děti	1	2	3	4	5
Hluk motocyklů/ mopedů	1	2	3	4	5
Hluční lidé pozdě v noci	1	2	3	4	5
Silniční doprava	1	2	3	4	5
Vlaky	1	2	3	4	5
Letadla	1	2	3	4	5
Větrná elektrárna	1	2	3	4	5
Sirény sanitky / policie	1	2	3	4	5
Továrna / stavba	1	2	3	4	5
Jiné (Prosíme vypište)	1	2	3	4	5
O8 Prosím, sdělte nám, jak hlučné se vám jednotlivé zdroje zdají: *(Zakroužkujte 1 číslo v každém řádku.)*	Vůbec ne	Mírně	Středně	Velmi	Extrémně
Zabezpečení domů a autoalarmy	1	2	3	4	5
Sousedé	1	2	3	4	5
Psí štěkání	1	2	3	4	5
Hrající si děti	1	2	3	4	5
Hluk motocyklů/ mopedů	1	2	3	4	5
Hluční lidé pozdě v noci	1	2	3	4	5
Hluk silniční dopravy	1	2	3	4	5
Vlaky	1	2	3	4	5
Letadla	1	2	3	4	5
Větrná elektrárna	1	2	3	4	5
Sirény sanitky / policie	1	2	3	4	5
Továrna / stavba	1	2	3	4	5
Jiné (Prosíme vypište)	1	2	3	4	5
O9 Jak hlučné se vám celkově zdá místo, ve kterém žijete? *(Zakroužkujte 1 číslo.)*	Vůbec ne	Mírně	Středně	Velmi	Extrémně
	1	2	3	4	5

O10 Za posledních 12 měsíců byste řekli, že úroveň hluku: *(Zakroužkujte 1 číslo.)*	Se zvýšila	Zůstává stejná	Se snížila
	1	2	3

O11 Myslíte si, že jste více nebo méně citlivý/(á) k hluku než ostatní lidé? *(Zakroužkujte 1 číslo.)*	Více citlivý	Asi stejně	Méně citlivý
	1	2	3

O12 Přemýšlíte-li o posledních 12 měsících nebo tak nějak, jak moc vás hluk z níže uvedených zdrojů trápí, ruší nebo obtěžuje,když jste doma? *(Zakroužkujte 1 číslo v každém řádku.)*	Vůbec ne	Mírně	Středně	Velmi	Extrémně
Zabezpečení domů a autoalarmy	1	2	3	4	5
Sousedé	1	2	3	4	5
Psí štěkání	1	2	3	4	5
Hrající si děti	1	2	3	4	5
Hluk motocyklů/ mopedů	1	2	3	4	5
Hluční lidé pozdě v noci	1	2	3	4	5
Hluk silniční dopravy	1	2	3	4	5
Vlaky	1	2	3	4	5
Letadla	1	2	3	4	5
Větrná elektrárna	1	2	3	4	5
Sirény sanitky / policie	1	2	3	4	5
Továrna / stavba	1	2	3	4	5
Jiné *(Prosím, vypište)*:	1	2	3	4	5

O13 Celkově, jak obtěžující je pro Vás hluk tam, kde žijete? *(Zakroužkujte 1 číslo.)*	Vůbec ne	Mírně	Středně	Velmi	Extrémně
	1	2	3	4	5

O14 Prosím, zaznamenejte přibližně, kdy býváte obvykle doma. *(Zakroužkujte 1 číslo v každém řádku.)*	Vždy	Obvykle	Někdy	Zřídka	Nikdy
Brzy ráno 6 - 9 h	1	2	3	4	5
Denní doba 9 - 18 h	1	2	3	4	5
Večer 18 - 22 h	1	2	3	4	5
Noc 22 - 6 h	1	2	3	4	5
Soboty	1	2	3	4	5
Neděle	1	2	3	4	5

O15 Když jste doma, shledáváte, že Vás obtěžuje hluk z různých zdrojů při Vašich aktivitách? *(Zakroužkujte "ANO" (1) nebo "NE" (2) pro každý zdroj a každou aktivitu.)*	Hluk ze silniční dopravy	Letecký hluk	Hluk větrné elektrárny	Jiný hluk
	ANO / NE			
Čtení / psaní/ soustředění	1 / 2	1 / 2	1 / 2	1 / 2
Sledování televize	1 / 2	1 / 2	1 / 2	1 / 2
Poslouchání rádia/ hudby	1 / 2	1 / 2	1 / 2	1 / 2
Konverzace	1 / 2	1 / 2	1 / 2	1 / 2
Společenský život nebo relaxace na zahradě	1 / 2	1 / 2	1 / 2	1 / 2
Spánek	1 / 2	1 / 2	1 / 2	1 / 2
Jiná aktivita *(Prosím, vypište):*	1 / 2	1 / 2	1 / 2	1 / 2

O16 Tyto zdroje hluku vždy: *(Zakroužkujte "ANO" (1) nebo "NE" (2) pro každý zdroj a každou aktivitu.)*	Hluk ze silniční dopravy	Letecký hluk	Hluk větrné elektrárny	Jiný hluk
	ANO / NE			
Způsobí, že se dům třese nebo vibruje	1 / 2	1 / 2	1 / 2	1 / 2
Způsobí, že televizní obraz bliká	1 / 2	1 / 2	1 / 2	1 / 2
Přiměje Vás zavřít okna	1 / 2	1 / 2	1 / 2	1 / 2
Vzbudí Vás	1 / 2	1 / 2	1 / 2	1 / 2
Vyleká Vás	1 / 2	1 / 2	1 / 2	1 / 2
Způsobí, že se vyhýbáte některým prostor.	1 / 2	1 / 2	1 / 2	1 / 2
Způsobí, že se vyhýbáte zahradě	1 / 2	1 / 2	1 / 2	1 / 2

V případě, že Vás obtěžuje ještě hluk z jiného zdroje, napište, prosím, o jaký hluk se jedná: _____

ČÁST 3

N*ásledující otázky jsou věnované Vašemu aktuálnímu naladění při vyplňování dotazníku. Prosím, na každé škále vyznačte (ideálně pomocí svislé čáry) místo, které nejlépe odpovídá Vašemu dojmu.*

A1 Jak se dnes cítíte ze zdravotního hlediska?

☹ _____ ☺

A2 Jak jste spokojen(a) s teplotou v místě, kde se teď nacházíte?

☹ _____ ☺

A3 Jaká vnímáte úroveň hluku v místě, kde se teď nacházíte?

☹ _____ ☺

A4 Jaká vnímáte množství čerstvého vzduchu v místě, kde se teď nacházíte?

☹ _____ ☺

A5 Tento dotazník jsem vyplňoval(a):	Doma	V práci	Ve veřejné dopravě	V kavárně/ restauraci	Jinde
	1	2	3	4	5

DOTAZNÍK KVALITA ŽIVOTA

DEMOGRAFICKÉ OTÁZKY

Poslední věcí, o kterou bych Vás ráda poprosila, je vyplnění následujících demografických otázek, které jsou velmi důležité pro vyhodnocení a správné zařazení nasbíraných dat.

D1 Jste muž nebo žena? *(Zakroužkujte 1 číslo.)*		**D2 Kolik je Vám let?** *(Prosím, vepište.)*	**D3 V jakém okrese máte trvalé bydliště?** *(Prosím, vepište.)*
Muž	Žena		
1	2		

D4 Jaké je Vaše nejvyšší dosažené vzdělání? (Zakroužkujte 1 číslo.)		**D5 Jaký je Váš rodinný stav?** *(Zakroužkujte 1 číslo.)*	
Základní	1	Svobodný(á)	1
Vyučení bez maturity	2	V libovolném partnerském soužití	2
Maturita	3	Ženatý/ vdaná	3
Vyšší odborné	4	Rozvedený(á)	4
VŠ	5	Vdovec/ vdova	5

D6 Kolik je ve Vaší domácnosti celkem osob včetně Vás?*(Prosím, vepište.)*	**D7 Kolik z toho je ekonomicky činných?** *(Prosím, vepište.)*	**D8 Kolik je závislých dětí, tj. dětí, které ještě nemají svůj vlastní příjem?**

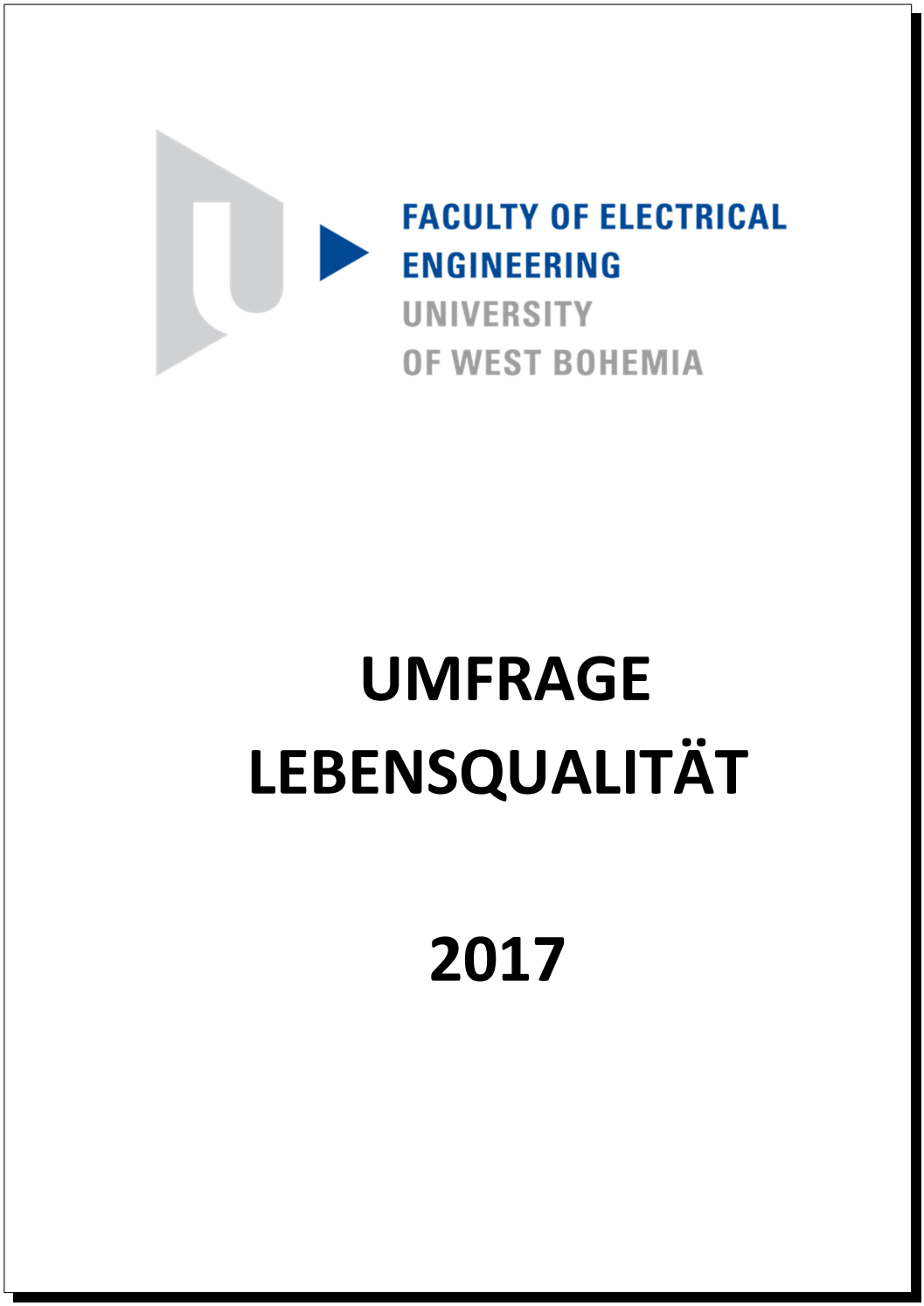
D9 Jaká je velikost obce, ve které žijete? *(Zakroužkujte 1 číslo.)*	
Do 999 obyvatel	1
1000 - 4999 obyvatel	2
5000 - 19 999 obyvatel	3
20 000 - 99 999 obyvatel	4
100 000 a více obyvatel	5

D10 Jak jste spokojený s výší vašeho měsíčního příjmu?	
Zcela nespokojený	1
Nespokojený	2
Docela spokojený	3
Spokojený	4
Velmi spokojený	5

D11 Jaké je Vaše sociální postavení? *(Zakroužkujte 1 číslo.)*	
Student/ učeň	1
Důchodce - pracující	2
Důchodce - nepracující	3
Nezaměstnaný	4
V domácnosti (vč. MD)	5
Zaměstnanec	6
Živnostník, Svobodné povolání, Soukromý zemědělec	7
Majitel firmy bez zaměstnanců (s.r.o., a.s., v.o.s.)	8
Majitel firmy se zaměstnanci	9

Velmi Vám děkuji za Vaši účast v průzkumu!

B. Questionnaire for Bavaria



LEBENSQUALITÄT

Diese Umfrage dient zum Zweck der Erhebung von Daten für eine Doktorarbeit (an der Elektrotechnischen Fakultät der Westböhmischen Universität in Pilsen), die sich mit dem Umgang von Lärm und dessen Auswirkungen auf die menschliche Gesundheit und Psyche befasst.

Organisatorin der Umfrage (Ing. Zuzana Kabešová) bestätigt, dass alle Antworten anonym sowie nur für wissenschaftliche Zwecke verwendet und nicht an Dritte weitergegeben werden.

Der Fragebogen ist in vier Teile gegliedert - Teil 1 (6 Fragen) widmet sich Ihrer Zufriedenheit mit Ihrem Wohnumfeld, Teil 2 (9 Fragen) ist dem Lärm in Ihrer Umgebung gewidmet, Teil 3 (5 Fragen) untersucht Ihre aktuelle Stimmung und der letzte Teil enthält demografische Fragen.

Einige Fragen können übersprungen werden, wenn Sie das Thema nicht betrifft - die Hinweise zum Überspringen wurden immer vor betreffende Fragen angegeben und farblich bezeichnet.

Bitte versuchen Sie, alle Fragen zu beantworten.

Das Ausfüllen des Fragebogens dauert etwa 15-25 Minuten.

TEIL 1

F1 Wo wohnen Sie? Es genügt die Ortschaft mit dem Stadtteil oder dem Straßennamen (z.B. München - Alpenstraße / Obing - hinter dem Bahnhof)	Ortschaft	Straße
F2 Wie lange wohnen Sie bei Ihrer aktuellen Adresse?	Jahre	Monate

Die nächste Frage F3 beantworten Sie nur in dem Fall, wenn Sie vor kurzem umgezogen sind. Falls Sie in diesem Gebiet länger leben, können Sie zur Frage Nr. 4. gehen.

F3.a Wo haben Sie vorher gewohnt?	Ortschaft	Straße
F3.b Wann sind Sie umgezogen?	Jahr	

F3.c Welche Gründe haben Sie zum Umziehen gehabt? *(Für jeden Grund wählen Sie eine Option aus wie wichtig es für Ihren Umzug war.)*	Extrem wichtiger Grund	Sehr wichtiger Grund	Mittel wichtiger Grund	Nicht sehr wichtiger Grund	Völlig unwichtiger Grund
Entfernung zur Arbeit	1	2	3	4	4
Entfernung zur Schule	1	2	3	4	4
Bezahlbarer Wohnraum	1	2	3	4	4
Wohnqualität	1	2	3	4	4
Wohnumgebungsqualität	1	2	3	4	4
Andere *(Bitte ausfüllen):*	1	2	3	4	4

LEBENSQUALITÄT

F4 Erwägen Sie zur Zeit einen Umzug aus Ihrer Wohnung/ Haus?	JA	1
	NEIN	2

F4.a Wenn ja, warum? *(Bitte, ausfüllen)*	
F4.b Was würde Sie überzeugen trotz der oben genannten Gründe weiter wohnen zu bleiben? *(Bitte, ausfüllen)*	

F5 Bitte markieren Sie, wie wichtig sind für Sie und Ihren Haushalt folgende Faktoren, die Ihre Lebensqualität beeinflussen können.	Extrem wichtig	Sehr wichtig	Mittel wichtig	Nicht sehr wichtig	Völlig unwichtig
Straßensauberkeit	1	2	3	4	5
Qualität lokaler Schule	1	2	3	4	5
Das Volumen des Straßenverkehrs der Gegend	1	2	3	4	5
Der Lärm von Straßenverkehr	1	2	3	4	5
Luftqualität	1	2	3	4	5
Flugzeuglärm	1	2	3	4	5
Zustand der Straßen und Gehwege	1	2	3	4	5
Verfügbarkeit von lokal. Erholungseinrichtung.	1	2	3	4	5
Verfügbarkeit von lokalen Arzt	1	2	3	4	5
Die Höhe der lokalen Kriminalität	1	2	3	4	5
Verfügbarkeit von lokalen Geschäften	1	2	3	4	5
Gefühl der persönlichen Sicherheit	1	2	3	4	5
Lärm von Windturbinen	1	2	3	4	5
Die Verfügbarkeit von öffentl. Verkehrsmitteln	1	2	3	4	5
Die Zugänglichkeit der Arbeit	1	2	3	4	5
Der Zugang zu Grünflächen / Natur	1	2	3	4	5
Andere (*Bitte, ausfüllen, wenn es einen anderen Faktor gibt):*	1	2	3	4	5

LEBENSQUALITÄT

F6 Bitte markieren Sie, wie zufrieden sind Sie mit den genannten Faktoren in Ihrem Wohnort.	Sehr zufrieden	Zufrieden	Weder zufrieden noch unzufrieden	Unzufrieden	Sehr unzufrieden
Straßensauberkeit	1	2	3	4	5
Qualität lokaler Schule	1	2	3	4	5
Das Volumen des Straßenverkehrs der Gegend	1	2	3	4	5
Der Lärm von Straßenverkehr	1	2	3	4	5
Luftqualität	1	2	3	4	5
Flugzeuglärm	1	2	3	4	5
Zustand der Straßen und Gehwege	1	2	3	4	5
Verfügbarkeit von lokal. Erholungseinrichtun.	1	2	3	4	5
Verfügbarkeit von lokalen Arzt	1	2	3	4	5
Die Höhe der lokalen Kriminalität	1	2	3	4	5
Verfügbarkeit von lokalen Geschäften	1	2	3	4	5
Gefühl der persönlichen Sicherheit	1	2	3	4	5
Lärm von Windturbinen	1	2	3	4	5
Die Verfügbarkeit von öffentl. Verkehrsmitteln	1	2	3	4	5
Die Zugänglichkeit der Arbeit	1	2	3	4	5
Der Zugang zu Grünflächen / Natur	1	2	3	4	5
Andere (*Bitte, ausfüllen, wenn es einen anderen Faktor gibt):*	1	2	3	4	5

T EIL 2 *Mit dem 2. Fragenteil möchte ich mehr über den Lärm in Ihrer Umgebung erfahren.*

F7 Wenn Sie zu Hause sind, wie oft merken Sie den Lärm aus folgenden Quellen?	Niemals	Selten	Manchmal	Oft	Immer
Die Sicherung der Häuser / Alarme	1	2	3	4	5
Nachbarn	1	2	3	4	5
Hundegebell	1	2	3	4	5
Spielende Kinder	1	2	3	4	5
Lärm von Mopeds/ Motoräder	1	2	3	4	5
Laute Leute spät in der Nacht	1	2	3	4	5
Straßenverkehr	1	2	3	4	5
Züge	1	2	3	4	5
Flugzeuge	1	2	3	4	5
Windturbine	1	2	3	4	5
Die Sirenen der Krankenwagen / Polizei	1	2	3	4	5
Fabrik / Bau	1	2	3	4	5
Andere *(Bitte, ausfüllen)*	1	2	3	4	5
F8 Bitte markieren Sie, wie laut Sie folgende Lärmquellen empfinden.	Gar nicht	Mäßig	Moderat	Sehr	Extrem
Die Sicherung der Häuser / Alarme	1	2	3	4	5
Nachbarn	1	2	3	4	5
Hundegebell	1	2	3	4	5
Spielende Kinder	1	2	3	4	5
Lärm von Mopeds/ Motoräder	1	2	3	4	5
Laute Leute spät in der Nacht	1	2	3	4	5
Straßenverkehr	1	2	3	4	5
Züge	1	2	3	4	5
Flugzeuge	1	2	3	4	5
Windturbine	1	2	3	4	5
Die Sirenen der Krankenwagen / Polizei	1	2	3	4	5
Fabrik / Bau	1	2	3	4	5
Andere *(Bitte, ausfüllen)*	1	2	3	4	5
F9 Wie laut empfinden Sie den Ort, an dem Sie leben?	Gar nicht	Mäßig	Moderat	Sehr	Extrem
	1	2	3	4	5

F10 Beurteilen Sie bitte, wie sich das Niveau des Lärms in Ihrem Ort in den vergangenen 12 Monaten verändert hat:	Hat sich erhöht.	Ist gleich geblieben.	Hat sich verringert.	**F11 Glauben Sie, dass Sie mehr oder weniger empfindlich gegenüber Lärm sind als andere?**	Mehr empf.	Gleich empf.	Weniger e.
	1	2	3		1	2	3

F12 Wenn Sie über die letzten 12 Monate nachdenken, wie viel hat Sie der Lärm aus den folgenden Quellen gestört oder belästigt, wenn Sie zu Hause sind?	Gar nicht	Mäßig	Moderat	Sehr	Extrem
Die Sicherung der Häuser / Alarme	1	2	3	4	5
Nachbarn	1	2	3	4	5
Hundegebell	1	2	3	4	5
Spielende Kinder	1	2	3	4	5
Lärm von Mopeds/ Motoräder	1	2	3	4	5
Laute Leute spät in der Nacht	1	2	3	4	5
Straßenverkehr	1	2	3	4	5
Züge	1	2	3	4	5
Flugzeuge	1	2	3	4	5
Windturbine	1	2	3	4	5
Die Sirenen der Krankenwagen / Polizei	1	2	3	4	5
Fabrik / Bau	1	2	3	4	5
Andere *(Bitte, ausfüllen):*	1	2	3	4	5

F13 Wie stark belastet Sie der Lärm an Ihrem Wohnort?	Gar nicht	Mäßig	Moderat	Sehr	Extrem
	1	2	3	4	5

F14 Bitte markieren Sie, wann sind Sie normalerweise unter der Woche zu Hause.	Immer	Gewöhnlich	Manchmal	Selten	Niemals
Morgens früh (6 - 9 Uhr)	1	2	3	4	5
Jeder Wochentag (9 - 18 Uhr	1	2	3	4	5
Abends (18 - 22 Uhr)	1	2	3	4	5
Nachts (22 - 6 Uhr)	1	2	3	4	5
Samstags	1	2	3	4	5
Sonntags	1	2	3	4	5

F15 Bei welchen Aktivitäten stört Sie der Lärm, wenn Sie zu Hause sind? *(Markieren Sie "JA" (1) oder "NEIN" (2) bei jeder Lärmquelle und jeder Aktivität.*	Straßen-verkehr-lärm	Flug-zeug-lärm	Wind-turbinen-lärm	Anderer-lärm
	JA / NEIN			
Lesen/ Schreiben / Konzentrieren	1 / 2	1 / 2	1 / 2	1 / 2
Fernsehen	1 / 2	1 / 2	1 / 2	1 / 2
Radio/ Musik hören	1 / 2	1 / 2	1 / 2	1 / 2
Unterhaltung	1 / 2	1 / 2	1 / 2	1 / 2
Sozialleben und Relaxing in Garten	1 / 2	1 / 2	1 / 2	1 / 2
Schlafen	1 / 2	1 / 2	1 / 2	1 / 2
Andere Aktivität *(Bitte, ausfüllen):*	1 / 2	1 / 2	1 / 2	1 / 2

F16 Diese Lärmquelle: *(Bitte entweder JA oder NEIN für jede Aktivität ankreuzen.)*	Straßen-verkehr-lärm	Flug-zeug-lärm	Wind-turbinen-lärm	Anderer-lärm
	JA / NEIN			
Bewirkt, dass das Haus schüttelt oder vibriert.	1 / 2	1 / 2	1 / 2	1 / 2
Bewirkt, dass Fernseherbild flattert.	1 / 2	1 / 2	1 / 2	1 / 2
Zwingt mich das Fenster zu schließen.	1 / 2	1 / 2	1 / 2	1 / 2
Weckt mich auf.	1 / 2	1 / 2	1 / 2	1 / 2
Erschreckt mich.	1 / 2	1 / 2	1 / 2	1 / 2
Verursacht, dass Ich einige Räume im Haus / Wohnung meide.	1 / 2	1 / 2	1 / 2	1 / 2
Bewirkt, dass Ich den Garten meide.	1 / 2	1 / 2	1 / 2	1 / 2

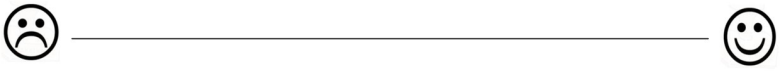
Falls Sie noch Lärm aus einer anderen Quelle stört, bitte, beschreiben Sie worum es geht: _____

TEIL 3

Folgende Fragen beziehen sich auf Ihre Stimmung während der Umfrage. Markieren Sie die Stelle auf jeder Skala, die am besten Ihrer Stimmung entspricht.

A1 Wie fühlen Sie sich heute in Bezug auf Ihre Gesundheit?

A2 Wie zufrieden sind Sie mit der Temperatur im Ort, wo Sie jetzt sind?



A3 Wie sehen Sie das Lärmniveau im Ort, wo Sie jetzt sind?

A4 Wie sehen Sie die Frischluftmenge im Ort, wo Sie sind?

A5 Diese Umfrage habe ich ausgefüllt:	Zu Hause	In der Arbeit	In einem Verkehrs-mittel	Im Cafe/ Restaurant	Woanders
	1	2	3	4	5

DEMOGRAFISCHE FRAGEN

Die letzten Fragen sind für die korrekte Klassifizierung und Bewertung der gesammelten Daten sehr wichtig sind. Deshalb bitte Ich Sie auch diese aus zu füllen.

D1 Sind Sie männlich oder weiblich?		**D2 Wie alt sind Sie?**
Männlich	Weiblich	
1	2	

D4 Was ist Ihr höchstes Bildungsniveau?		**D5 Wie ist Ihr Familienstand?**	
Realschule	1	Ledig	1
Berufsausbildung	2	In beliebigem Zusammenleben	2
Abitur	3	Verheiratet	3
Fachhochschule	4	Geschieden	4
Universität	5	Witwer/ Witwe	5
Andere:	6		

D6 Wie viele Personen leben in Ihrem Haushalt, darunter auch Sie?	**D7 Wie viele davon haben ein eignes Einkommen?**	**D8 Wie viele unterhaltspflichtige Kinder, d.h. Kinder, die noch nicht ein eigenes Einkommen haben leben in Ihrem Haushalt?**

D9 Wie groß ist Ihre Ortschaft, in der Sie leben?	
Bis 999 Einwohner	1
1000 - 4999 Einwohner	2
5000 - 19 999 Einwohner	3
20 000 - 99 999 Einwohner	4
100 000 und mehr Einwohn.	5

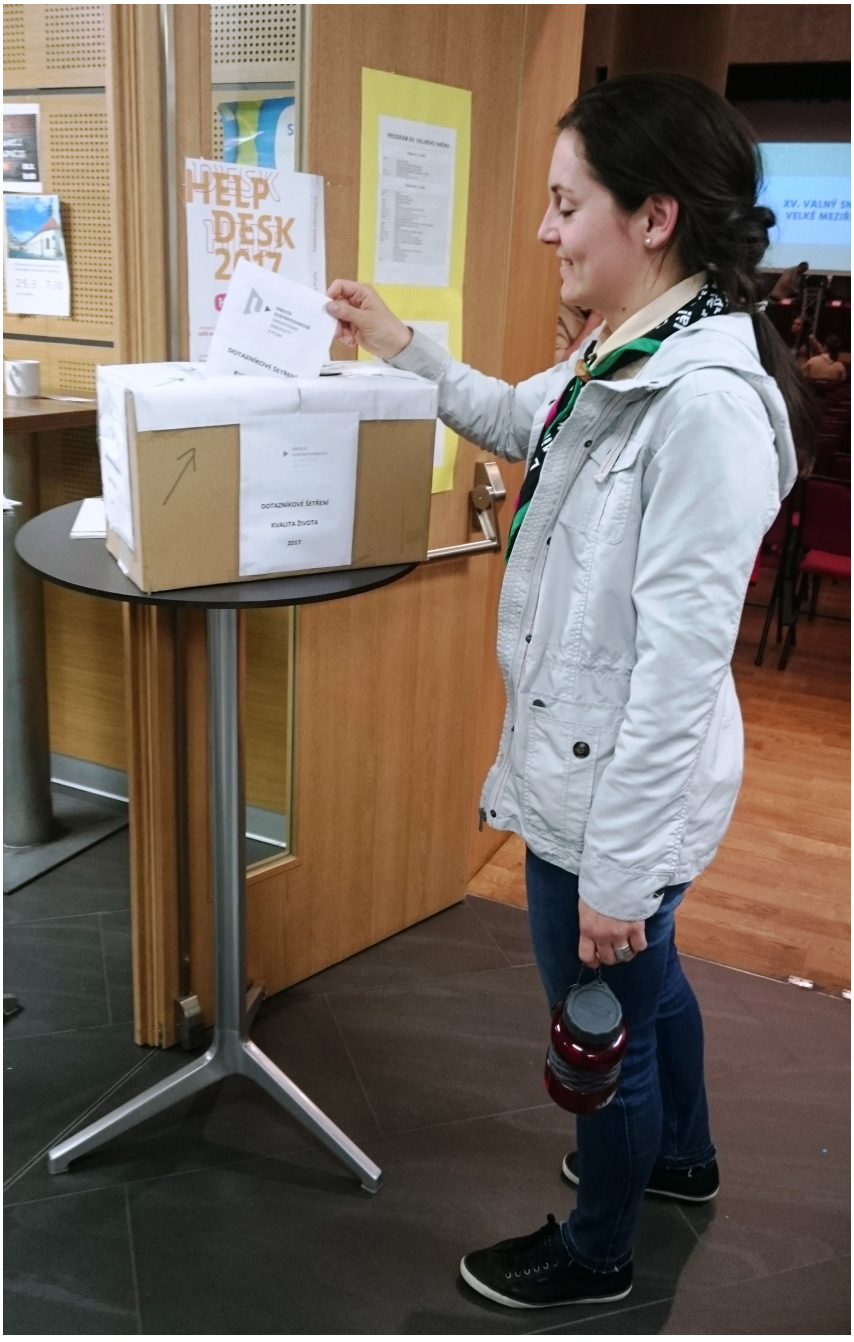
D10 Wie zufrieden sind Sie mit dem Betrag Ihres monatlichen Einkommens?	
Sehr unzufrieden	1
Unzufrieden	2
Ziemlich zufrieden	3
Zufrieden	4
Sehr zufrieden	5

D11 Wie ist Ihr sozialer Status?	
Student/ Lehrling	1
Erwerbstätiger Rentner/in	2
Rentner/in	3
Arbeitslos	4
Hausfrau (inkl. Mutterschaftsurlaub)	5
Arbeitnehmer/in	6
Gewerbetreibende / Unternehmer / Bauer	7
Firmeninhaber ohne Angestellte	8
Firmeninhaber mit Angestellte	9

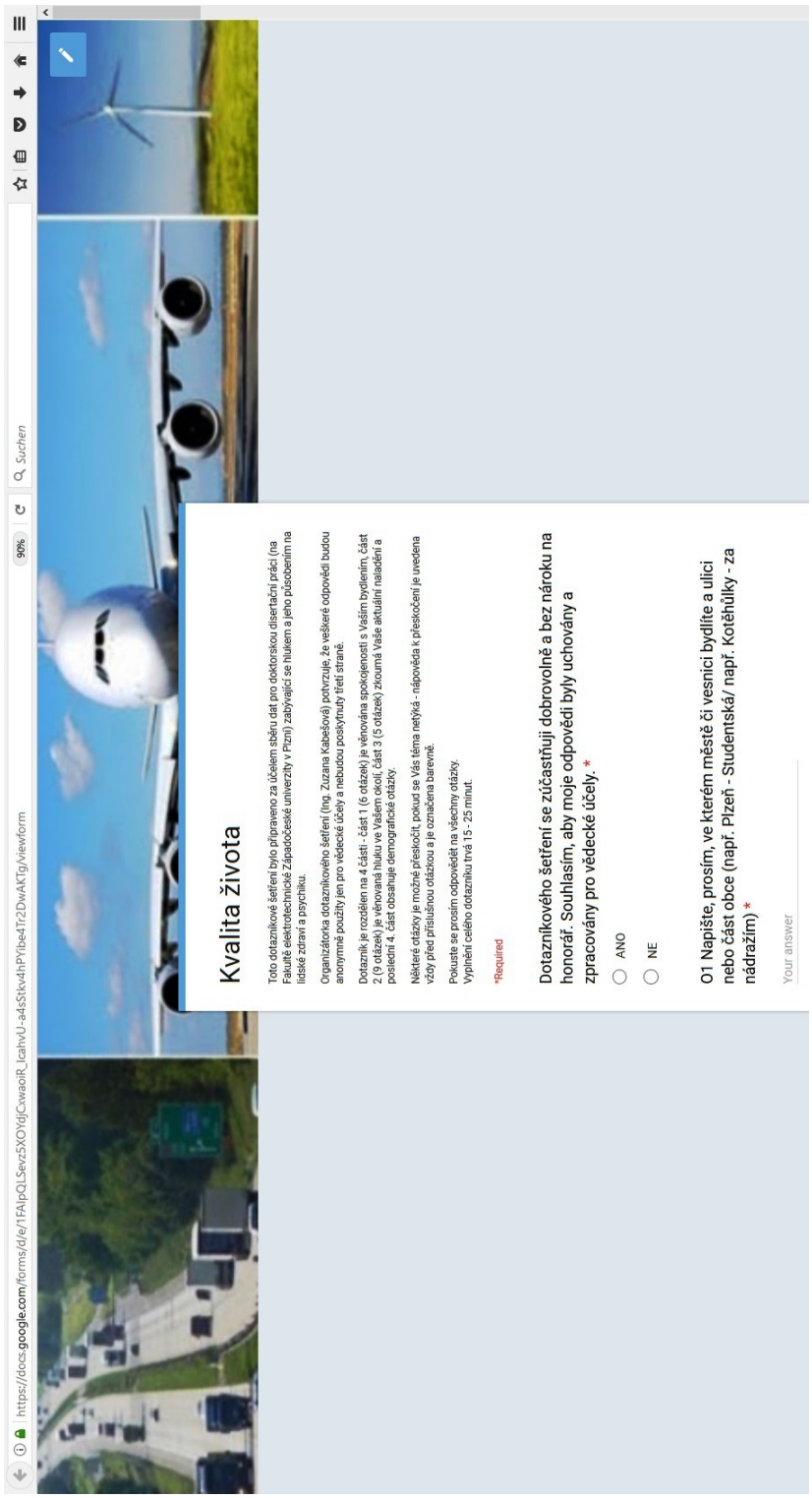
Vielen Dank für Ihre Zeit und Energie

die Sie aufgewendet haben für die Forschung!

C. Experiment 1 - Survey in the Czech Republic - Photo of a Respondent



D. Questionnaire - Online Version - Examples of Questions in Czech and German Language



02 Jak dlouho bydlíte na současné adrese? (roky / měsíce)

Your answer

Na další otázku č. 3 odpovídejte pouze v případě, že jste se do současného bydliště nedávno přistěhovali odjinud. Jestliže jste žili v této oblasti odjakživa, můžete přejít rovnou k otázce č. 4.

O3.a Jestliže jste se na současnou adresu přestěhoval(a) odjinud, kde jste bydlel(a) předtím? (Prosím, vypište.)

Your answer

O3.b Jestliže jste se na současnou adresu přestěhoval(a) odjinud, kdy to bylo? (Prosím, vypište rok.)

Your answer

O3.c Co bylo důvodem pro přestěhování se do současného bydliště? Pro každý z důvodů vypsaných níže vyberte jednu z možností, jak důležitý pro vás tento důvod k přestěhování se byl.

	Extrémně důležitý důvod	Velmi důležitý důvod	Středně důležitý důvod	Nepříliš důležitý důvod	Zcela nedůležitý důvod
Vzdálenost do práce	○	○	○	○	○
Vzdálenost do školy	○	○	○	○	○
Cenově dostupné bydlení	○	○	○	○	○
Kvalita bydlení	○	○	○	○	○
Kvalita okolí bydliště	○	○	○	○	○
Jiný (Prosím, níže vypište)	○	○	○	○	○

Jiný

Your answer

Dále vyplňují opět všichni.

O4 Zvažoval(a) jste v poslední době, že se odtud odstěhujete?

- ◯ ANO
- ◯ NE

O4.a Jestliže ano, proč? (Pokud jste neuvažoval(a) o přestěhování, odpovězte prosím pouze: NE)

Your answer

O4.b Co by Vás přimělo přes výše uvedené důvody zůstat?

Your answer

O5 Prosím zaznamenejte, jak důležité jsou pro Vás a Vaši domácnost níže uvedené faktory, které mohou ovlivnit kvalitu Vašeho života.

	Extrémně důležité	Velmi důležité	Středně důležité	Nepříliš důležité	Zcela nedůležité
Čistota ulice	◯	◯	◯	◯	◯
Kvalita místní školy	◯	◯	◯	◯	◯
Objem silniční dopravy ve Vaší oblasti	◯	◯	◯	◯	◯
Hluk ze silniční dopravy	◯	◯	◯	◯	◯
Kvalita ovzduší	◯	◯	◯	◯	◯
Hluk z letecké dopravy	◯	◯	◯	◯	◯
Stav silnic a chodníků	◯	◯	◯	◯	◯
Dostupnost místních rekreačních zařízení	◯	◯	◯	◯	◯
Dostupnost místního praktického lékaře	◯	◯	◯	◯	◯
Úroveň místní kriminality	◯	◯	◯	◯	◯
Dostupnost místních obchodů	◯	◯	◯	◯	◯

Otázka č. 15 je rozdělena na 4 části - a,b,c,d. Vyplňte prosím pole odpovědí ke zdroji hluku, který se vyskytuje v místě Vašeho bydliště.

a) HLUK ZE SILNIČNÍ DOPRAVY
b) HLUK LETADEL
c) HLUK VĚTRNÉ ELEKTRÁRNY
d) JINÝ HLUK

(Např. Bydlím ve větším městě, kde není v blízkosti ani letiště ani větrná elektrárna –> vyplním pole týkající se hluku ze silniční dopravy a ostatní vynechám. Často se v našem okolí konají rockové koncerty –> vyplním ještě pole "Jiný hluk" a připojím informaci, že se jedná o rockové koncerty.)

Nevyplněné pole bude chápáno tak, že se u Vás daný zdroj nevyskytuje a tudíž Vás neobtěžuje.

O15.a Když jste doma, shledáváte, že Vás obtěžuje HLUK ZE SILNIČNÍ DOPRAVY při Vašich aktivitách?

	ANO	NE
Čtení/ psaní/ soustředění	○	○
Sledování televize	○	○
Poslouchání rádia/ hudby	○	○
Konverzace	○	○
Společenský život nebo relaxace na zahradě	○	○
Spánek	○	○
Jiná aktivita (Prosím, níže vypište.)	○	○

Případná jiná aktivita:

Your answer

Lebensqualität

TEIL 3

Folgende Fragen beziehen sich auf Ihre Stimmung während der Umfrage.
Markieren Sie die Stelle auf jeder Skala, die am besten Ihrer Stimmung entspricht.

Wie fühlen Sie sich heute in Bezug auf Ihre Gesundheit?

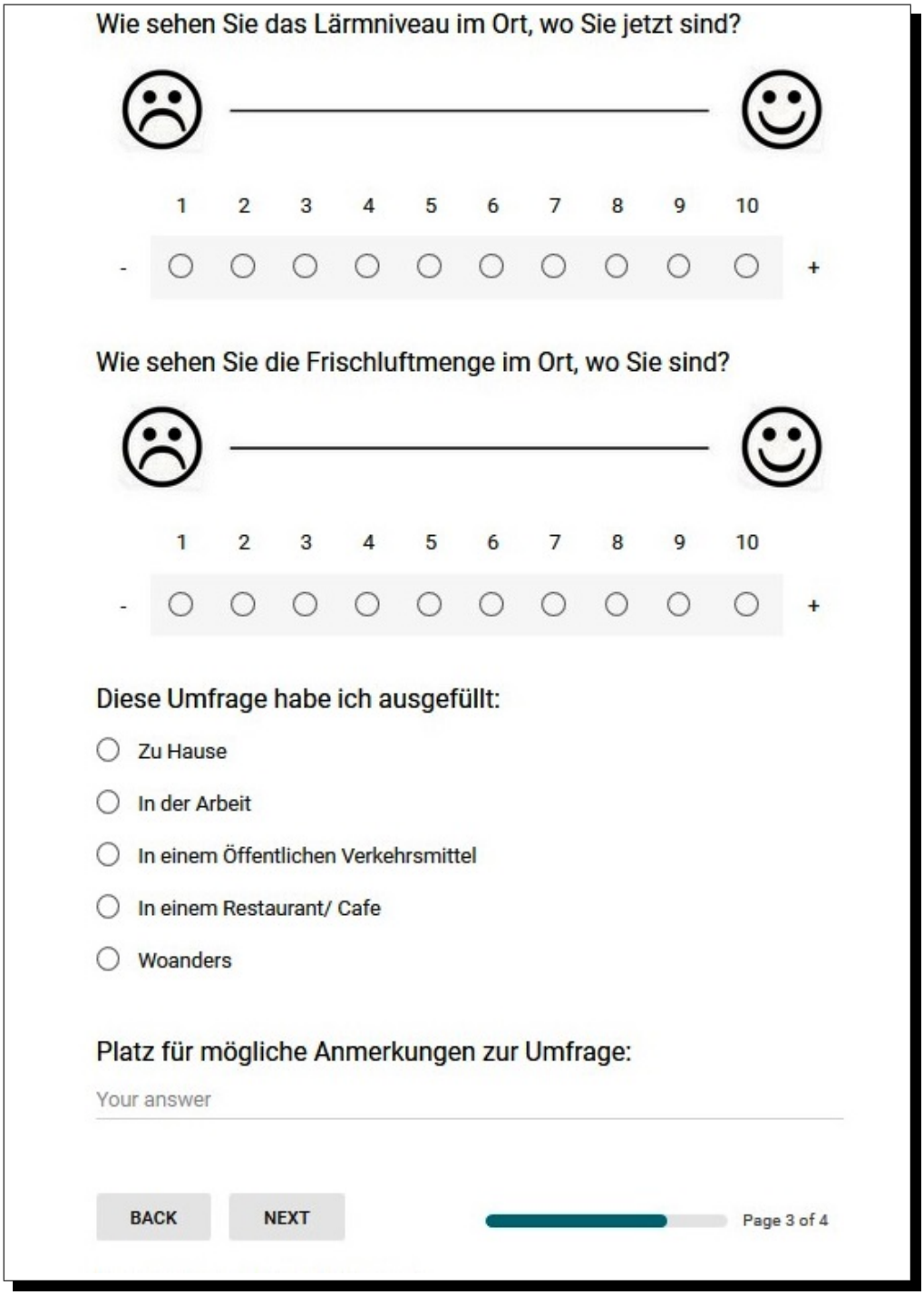
	1	2	3	4	5	6	7	8	9	10	
-	○	○	○	○	○	○	○	○	○	○	+

Wie zufrieden sind Sie mit der Temperatur im Ort, wo Sie jetzt sind?

	1	2	3	4	5	6	7	8	9	10	
-	○	○	○	○	○	○	○	○	○	○	+

Wie sehen Sie das Lärmniveau im Ort, wo Sie jetzt sind?

	1	2	3	4	5	6	7	8	9	10	
-	○	○	○	○	○	○	○	○	○	○	+


Wie sehen Sie das Lärmniveau im Ort, wo Sie jetzt sind?
1 2 3 4 5 6 7 8 9 10
-
+
Wie sehen Sie die Frischluftmenge im Ort, wo Sie sind?
1 2 3 4 5 6 7 8 9 10
-
+
Diese Umfrage habe ich ausgefüllt:
Zu Hause
In der Arbeit
In einem Öffentlichen Verkehrsmittel
In einem Restaurant/ Cafe
Woanders
Platz für mögliche Anmerkungen zur Umfrage:
Your answer
BACK
NEXT
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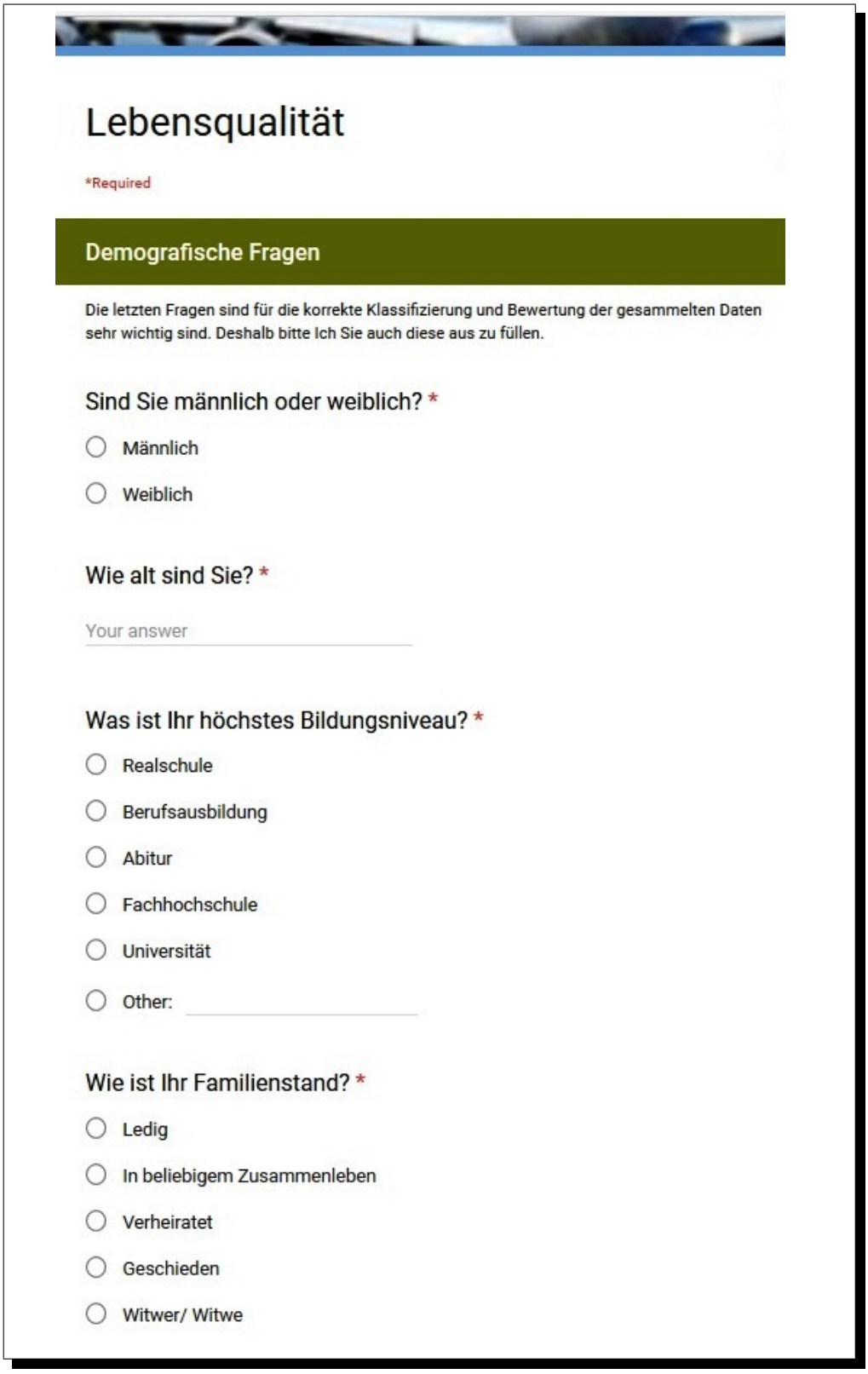


Lebensqualität

*Required

Demografische Fragen

Die letzten Fragen sind für die korrekte Klassifizierung und Bewertung der gesammelten Daten sehr wichtig sind. Deshalb bitte Ich Sie auch diese aus zu füllen.

Sind Sie männlich oder weiblich? *

- Männlich
- Weiblich

Wie alt sind Sie? *

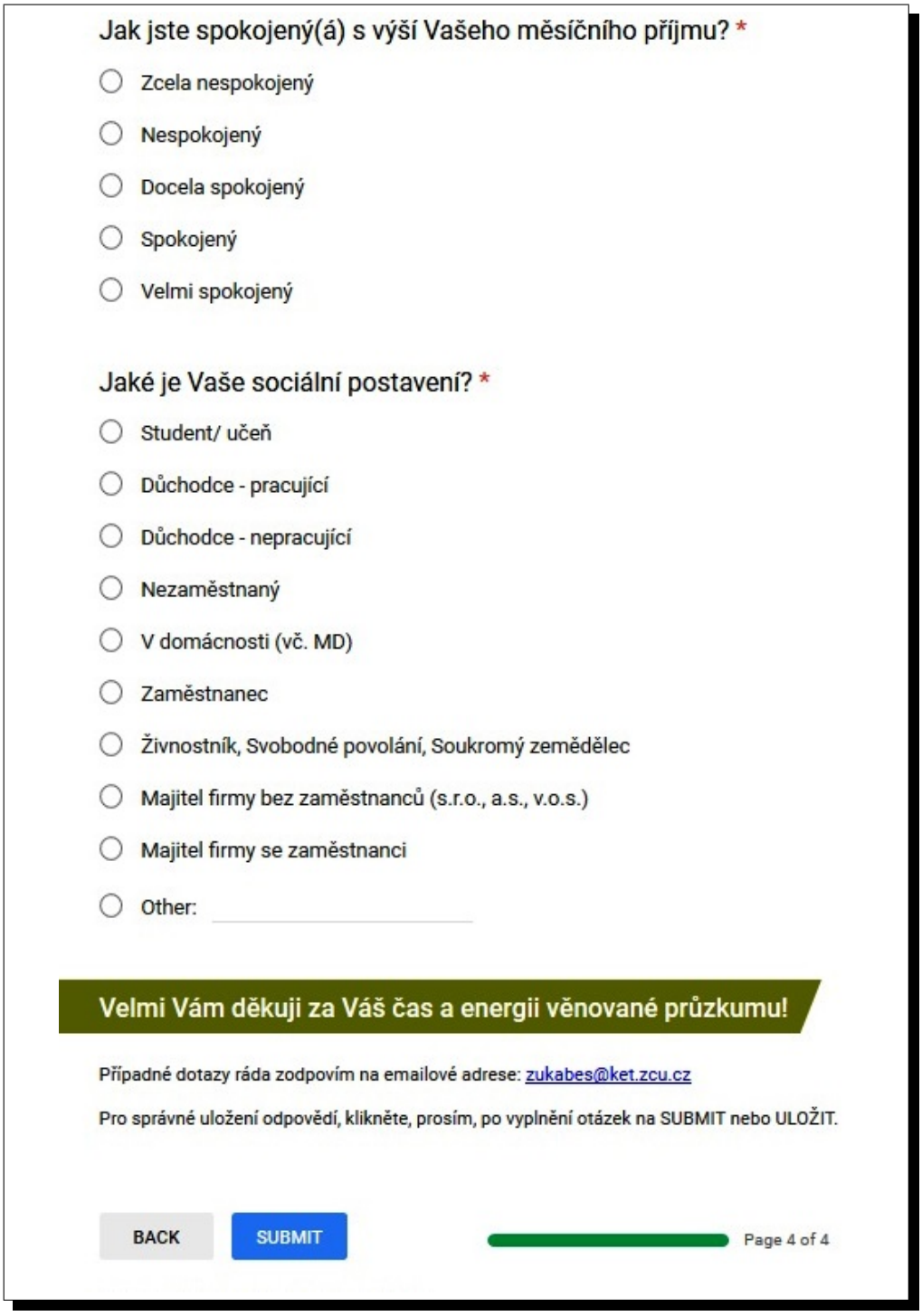
Your answer

Was ist Ihr höchstes Bildungsniveau? *

- Realschule
- Berufsausbildung
- Abitur
- Fachhochschule
- Universität
- Other:

Wie ist Ihr Familienstand? *

- Ledig
- In beliebigem Zusammenleben
- Verheiratet
- Geschieden
- Witwer/ Witwe



Jak jste spokojený(á) s výší Vašeho měsíčního příjmu? *

- Zcela nespokojený
- Nespokojený
- Docela spokojený
- Spokojený
- Velmi spokojený

Jaké je Vaše sociální postavení? *

- Student/ učeň
- Důchodce - pracující
- Důchodce - nepracující
- Nezaměstnaný
- V domácnosti (vč. MD)
- Zaměstnanec
- Živnostník, Svobodné povolání, Soukromý zemědělec
- Majitel firmy bez zaměstnanců (s.r.o., a.s., v.o.s.)
- Majitel firmy se zaměstnanci
- Other:

Velmi Vám děkuji za Váš čas a energii věnované průzkumu!

Případné dotazy ráda zodpovím na emailové adrese: zukabes@ket.zcu.cz

Pro správné uložení odpovědí, klikněte, prosím, po vyplnění otázek na SUBMIT nebo ULOŽIT.

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