Determining the parameters of noise pollution in the central area of the Almaty city in Kazakhstan

by Mohammad Rudiansyah

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Communication

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Abstract: One of the adverse effects of industrialization is noise pollution, which disturbs the mental health and tranquility of urban residents and is the source of numerous social tensions. Twenty stations in the central areas of Almaty with varying uses during the morning, afternoon, and evening rush hours were measured for this study. The objectives of this paper include determining sound indices, identifying potential sound sources, and calculating the relative contribution of each to the overall urban noise level. Additionally, 400 questionnaires were distributed to individuals to assess noise pollution's effects on individuals. The average maximum value of TNI (Traffic Noise Index) in residential and commercial use is 85.4 dB(A), and the maximum value of Leq (Equivalent continuous sound level) in commercial use is 86 dB(A). In addition, 50 city bus drivers were examined to determine the impact of noise in this environment. The results revealed that as Leq increases, the number of unsafe acts increases. The questionnaires revealed that people are significantly more dissatisfied with noise pollution at stations with higher sound levels.

Keywords: Noise pollution, Urban areas, TNI, Almaty

1 Introduction

In the last three decades, environmental pollution has received more global attention than ever. In the meantime, noise pollution in cities is a pervasive but global problem in most nations. Today, noise pollution is a significant factor in determining the quality of life in cities and harms social welfare [1]. Because noise pollution is not stable in the environment, is not a chemical reaction, and does not leave lasting and visible effects like water and soil pollution, it has received less attention and should be treated similarly to other contaminants [2]. Sound is a pressure oscillation that stimulates the sense of hearing in an elastic medium. In other words, the sound is any change in air pressure directly detected by the human ear. Noise pollution refers to the unintended propagation of audible waves that can be irritating to the ear [3]. Today, noise pollution is one of the most significant environmental factors in most large and densely populated cities. Throughout the day, people engage in various activities, exposing them to various sounds; therefore, noise exposure occurs not only in the workplace but also during non-work activities such as recreation, transportation, and shopping [4].

Noise pollution is one of the most effective forms of environmental pollution, annoying urban residents and workers, and has received significant attention as a health and safety risk factor worldwide [5]. Determining the difference in sound level between the stations reveals that as the sound level in the city rises, the difference in sound level

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decreases, indicating that motor vehicle traffic will become more regular [6, 7].

Different urban areas have been analyzed to investigate noise pollution, and sound data has been collected in numerous studies [8]. Noise from intercity vehicles, including motorcycles, passenger cars, and heavy and semi-heavy vehicles, is a significant contributor to noise pollution in cities, and 70 to 90 percent of urban noise pollution is caused by vehicles [9]. In general, noise pollution in cities can be caused by factors such as the proximity of residential areas to busy roads, the presence of worn-out automobiles in the city, the presence of workshops and constructions, the passage of flight lines over the city, and the passage of rail lines through certain areas, amongst many others [10, 11]. A 2011 World Health Organization (WHO) study reveals that one-third of Europeans suffer from daytime noise, and one-fifth experience sleep disturbances due to traffic noise alone [12]. Noise pollution has reached an alarming level over the years due to the rapid expansion of industry, urbanization, and other transportation and communication systems [13, 14].

Noise pollution at high sound pressure levels (greater than 85 dB) directly affects the hearing organ, including temporary changes in the hearing threshold and permanent hearing loss with prolonged exposure [15]. In addition, at lower levels (between 50 and 80 dB), its primary effects are categorized as an annoyance, disturbance, bother, and intrusion. In other words, one of the effects of sound is its influence on individuals' nervous systems, mental states, and behavior [16, 17]. Physiological and psychological effects caused by repeated and continuous sounds in humans typically manifest gradually and over time, whereas such complications do not occur in individuals unaffected by sound [18]. The effects of transportation activities, including noise pollution and its consequences, must be reduced or controlled. The physiological and psychological effects of sound on humans tend to manifest gradually, and its long-term effects on the human nervous system are detrimental [19].

Psychologically, sound pollution is an undesirable, unpleasant, or unwanted sound, whereas quantitatively, noise is a collection of sounds with varying wavelengths and intensities that lack a distinct composition and are unpleasant to the ear [20]. Anomalous sound results from sporadic changes in ambient air pressure and consists of annoying, unwelcome sound waves [21]. Since exposure to excessive noise diminishes health and harms all living organisms, it is regarded as one of the environmental pollutants [22]. The immediate and short-term effects of noise pollution are not harmful to humans, as sound has a short half-life and cannot remain in the environment for long; however, this short-term durability has a significant long-term impact on humans and their surroundings. Often, sound's physiological and psychological effects on humans manifest gradually, and over time, it directly affects the human nervous system, and its adverse effects manifest [23]. The psychological effects of noise vary depending on the individual, the situation, and the time. In general, it can be stated that a noisy environment disrupts conversation and content comprehension, reduces brain activity and causes incoherence in physical tasks, diminishes learning power, and increases the number of errors [24].

In developed nations, sound maps implement and construct noise-sensitive routes and areas. By creating a sound map, the decibel levels in all urban and rural areas and areas where noise exceeds the allowable limit will be determined, and control measures will be taken in those areas [25]. The management, presentation, and analysis of sound data to visualize the results of sound measurements for urban planners and engineers is an essential factor in resolving the noise pollution problem and preventing it from becoming more complicated [26].

Considering that noise pollution causes neurological diseases, heart attacks, elevated heart rate and blood pressure, shortness of breath, temporary and permanent deafness, etc.; Because no comprehensive research has been conducted on noise pollution in Almaty, the present study must be conducted. In this study, an effort was made to present a complete and exhaustive analysis of noise pollution based on the working method and findings of other studies conducted in the field of noise pollution and its benefits. In other studies in this field, the state of noise pollution or the level of annoyance caused by noise pollution is typically investigated. In the present study, the noise pollution situation and the level of the annoyance of Almaty's residents have been evaluated simultaneously. The current study investigates the amount of noise pollution in 20 bus stations and the level of annoyance that noise pollution causes people.

2 Materials and method

This section introduces the methods for determining the location of sound measurement stations as well as the specifications of the sound meter. Methods for measuring the stress of bus drivers in response to noise and the number of unsafe acts have also been investigated.

2.1 Determining sound measuring stations

Twenty stations were determined based on the route map, intersections, and the concentration of sensitive points. Among the selected points were four educational user stations, three therapeutic user stations, five residential and commercial user stations, and four commercial user stations. These measurements were conducted for five consecutive weeks during March and April 2021, on working days, during rush hour, and between 7 am and 8 pm. Weekends are excluded during the week due to reduced traffic flow. Each measurement station lasted 10 minutes which was repeated three times. The first measurement was from 7 to 9 am, when people left for work; the second was from 11 to 1 pm, and the third was from 6 to 8 pm when people returned home and the working day ended. Sound parameters L_{90}, L_{50}, L_{10}, L_{min}, L_{max}, and L_{eq} (Equivalent continuous sound level), were measured. TNI (Traffic Noise Index) and NPL (Noise Pollution Level) were calculated [27]. Also, using SPSS software, audio indicators were compared in different stations.

Almaty is Kazakhstan's principal commercial, cultural hub, and most populous and cosmopolitan city (with a population of about 2 million). The city is situated in the southern mountainous region of Kazakhstan, close to the border with Kyrgyzstan. In the current study, the noise pollution in the Almaty city center has been examined. According to Figure 1, twenty stations have been chosen for this purpose.

2.2 Introducing sound level meter tools

The sound indicators were measured with a Danish-made B&K (Bruel & Kjaer) analyzer, model number 2236. The sound level meter was calibrated prior to the measurement, and a weighting network, which operates according to the human ear's sensitivity, was used to measure the sound level and frequency. At the height of 1.5 meters and an angle of 75 degrees, measurements were taken over 10-minute intervals [28].

2.3 Measurement of stress parameters between bus drivers

Fifty active bus drivers in this urban area were surveyed to determine the impact of ambient noise on them. The Philip L. Rice Questionnaire, approved by the National Institute of Mental Health (NIMH) and has a reliability of 0.92 [29, 30], was used to measure job stress. This questionnaire consists of 57 questions, including three sections on interpersonal relationships, physical condition, and work-related interests. Each question is answered using one of five Likert scale options (never, rarely, sometimes, most of the time, and always). As a result of the scoring method, the range of possible responses to each question is from 1 to 5, which is the opposite of some scoring questions. The results of quantifying each question are then aggregated to determine the job stress scores of the drivers. Less than 116 indicates

Figure 1: Location of the investigated stations in the center of Almaty

low job stress, 140 to 116 indicates moderate job stress, and more than 140 indicates high job stress. The text of the said questionnaire is presented in the appendix section.

The sampling technique of unsafe driving was employed to investigate the unsafe driving behaviors of motorists. Initially, a list of 70 unsafe behaviors was compiled by analyzing traffic laws [31, 32]. It was decided to observe each minute of movement in each direction at a random time that had been pre-selected; for imperceptible driver control, the observations were made simultaneously with the sound measurement. Because the behavior of each individual can change at any time relative to the last moment, the duration of each observation was kept to a minimum and was only long enough for the observer to observe the action and determine whether it is safe or unsafe. In this research, each observation could take no longer than five seconds. Microphones were attached to the drivers' collars to measure the drivers' exposure to the equivalent sound level. At the beginning of each lane, drivers were instructed to leave their side windows open for 10 minutes to determine the maximum audible sound level.

3 Results and discussion

This section presents the results of the measured parameters and compares their values. Also discussed are the questionnaire's results. Lastly, information regarding the degree to which bus drivers are exposed to ambient noise and its impact on their performance is examined.

3.1 NPL and L_{eq} results

Based on the findings of this paper, the stations in commercial use had the highest NPL of all measurements at 89.2 dB(A), while the residential ward stations had the lowest at 62.3 dB(A). Figure 2 displays the L_{eq} values for the three measurements across the five applications.

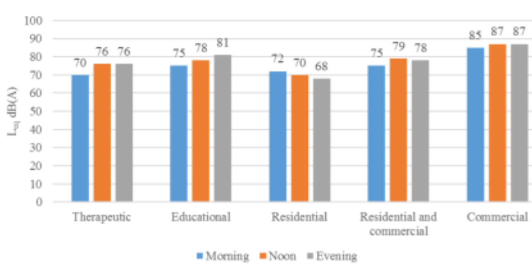

Figure 2: L_{eq} in five uses

Only 22% of the measurements were acceptable, with the L_{eq} measured at all stations exceeding the standard. 77.1 dB(A) is the average L_{eq} for the study area. 57% of the measured Leq were deemed unacceptable, 21% were deemed completely unacceptable, 15% were deemed slightly acceptable, and 7% were deemed entirely acceptable.

3.2 Compare the amount TNI and L_{eq}

In a station with residential and commercial use, the maximum values of TNI in the total measurement are 100.2 dB(A), while the minimum is 53.3 dB(A) in commercial use. As shown in Figure 3, L_{eq} is only greater than TNI in commercial applications.

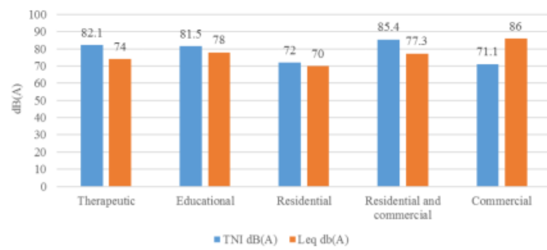

Figure 3: Mean TNI and L_{eq} in five uses

The average TNI calculated at all stations is 78.4 dB(A), higher than the average L_{eq} measured in all uses except commercial. The greater the difference, the more annoying the noise pollution from traffic. In therapeutic use, traffic noise is problematic and potentially dangerous for patients who need relaxation [29]. The evening shift measured the highest TNI level at 85.5 dB(A), which shows the irregular movement of cars and the big difference between the moment of calm and the sound of traffic. The reason for this is the confinement between the three main streets, the proximity to the busy street, and the existence of a taxi station. The enclosure of the main street with tall commercial, office, and residential buildings is one of the factors recording this amount. Indeed, establishing educational and medical centers in such situations is not desirable, and it is necessary to take the necessary measures to prevent the entry of sound waves. The new urban planning program should pay special attention to noise pollution indicators until new locations are desirable for citizens and as safe as possible.

Table 1: Minimum and maximum sound indices measured at 20 stations

	NPL	TNI	L_{90}	L_{50}	L_{10}	L_{eq}
Maximum measured parameter	90.1	100.2	81.1	84.1	91.2	80.9
Minimum measured parameter	62.1	53.3	52.3	57.4	63.4	57.3

Table 2: The results of the correlation test in examining the relationship between the main variables of the research with each other

Two variables examined	Pearson	P-value
Stress and L_{eq}	0.05	0.032
Number of traffic accidents and L_{eq}	0.097	0.045
Stress and the number of unsafe acts	0.027	0.041
Stress and the number of traffic accidents	0.087	0.032
Number of unsafe acts and number of traffic accidents	−0.018	0.041
Number of unsafe actions and L_{eq}	0.179	0.023

3.3 L_{eq}, TNI, L_{90}, L_{50}, L_{10} and NPL values

Measurement sound indices for the 20 stations considered are given in Table 1. Minimum and maximum values are recorded to determine the range of each indicator.

The maximum TNI value is 100.2 dB(A) at noon. The highest recorded L_{eq} value was 80.9 dB(A), which is due to the proximity of the site to the bridge and the reflection of the bridge walls and the return of noise from the movement and horn of cars, high-speed car traffic, asphalt wear and tear, heavy vehicles and the narrowness of this street makes the sound louder than standard.

3.4 Results of questionnaires

This study distributed questionnaires in 25 percent of residential applications, 15 percent of commercial applications, 20 percent of therapeutic applications, 20 percent of educational applications, and 20 percent of both commercial and residential applications. Fifty-five percent of respondents were male, and 45 percent were female. The primary purpose of the questionnaire is to investigate the various forms of noise pollution caused by traffic and other sources and assess the level of awareness and the mental reaction of the region's residents to various noise disturbances. The uniformity of the station's environmental conditions was considered when measuring the overall sound pressure level (SPL) and filling out the questionnaires.

Eighty-three percent of individuals responded positively to the question regarding the presence of annoying noise. Among these, the noise caused by car horns has the highest proportion of respondents who are dissatisfied with the traffic noise. In 51% of individuals, annoying sounds interfered with conversations with others. Additionally, 35% of respondents reported interference while listening to music or watching television. In 50% of these individuals, traffic noise causes insomnia. Fifty-nine percent of people are also irritated by day and nighttime traffic noise. The surrounding sound level is loud for 35% of respondents, medium for 50%, and quiet for 15%. The evening was the time when respondents were most dissatisfied with the noise, while noon was when they were least dissatisfied. 62% of participants were unaware of the adverse health effects of noise pollution.

3.5 Investigating the effects of noise on bus drivers

All the drivers studied were male and married. The mean age of the subjects was 39.84 (±9.081) years, most of whom were 30-45 (67.3%) years. 74.1% of drivers worked in shifts and 25.9% full time. According to reports, 35.2% of drivers have had at least one traffic accident. Findings on occupational stress showed that 76% of drivers have high-stress levels, 16% have medium stress levels, and 8% have low-stress levels. In investigating unsafe practices, the results showed that 42.71% of observed practices are unsafe. The results of noise measurements showed the average noise exposure of drivers equal to 76.35 dB(A). The results of the correlation study of the main variables of the research are presented in Table 2.

The results of a regression test examining the relationship between job stress and driver noise exposure to the percentage of unsafe actions revealed that as the level of driver exposure to the equivalent level of sound increased, so did the percentage of unsafe actions. Figure 4 shows the relationship between the number of unsafe actions and L_{eq}.

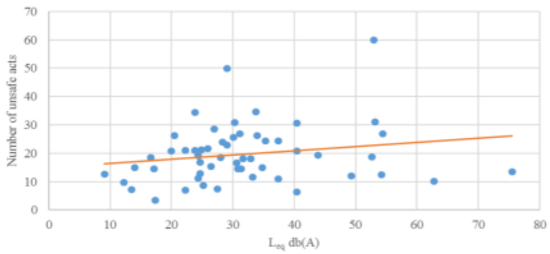

Figure 4: Relationship of L_{eq} with the number of unsafe actions

The results of a logistic regression test in a relational study of job stress and noise exposure of drivers, with or without the presence of a traffic accident in 2021, which was recorded, also showed that drivers' exposure to equivalent levels of noise and job stress increased, so did the likelihood of an accident. Figure 5 shows the current state of the relationship between job stress and accidents.

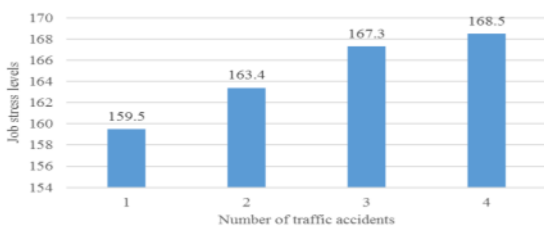

Figure 5: Relationship between job stress and the number of recorded traffic accidents

4 Conclusion

Almaty's central area has many noise pollution problems because it has many people. It also has many highways, busy squares and streets, heavy vehicle traffic, residential areas, and worn-out asphalt as this problem has become even more real to people who are not paying attention. One of the most obvious ways cars makes noise is when the wheels hit the road. Most of the streets in this area do not seem like they could be made wider because there are almost-new buildings and multiple floors on them. However, it is suggested that the streets be paved and made wider as much as possible. In commercial and residential use, the average TNI was 85.4 dB(A) higher than in other uses. The noise index in this area has gone down because of too much car traffic, the mixing of residential and commercial areas, the closeness of high-rise residential buildings to the streets, an increase in reflective levels, the lack of green spaces, and the number of urban buildings. 57.3 dB(A) is the lowest L_{eq} value for homes and green space. The park's green space is a big part of this number because it is far from the street and has no reflective surfaces.

The questionnaires revealed that people's dissatisfaction with noise pollution is significantly greater at stations with higher sound levels. In addition, no significant correlation was found between age groups and indicators of discontent with noise pollution. While for gender and occupation variables, a significant relationship was observed between the results, such that men are more dissatisfied with noise pollution than women, and bus drivers are more dissatisfied than those in other occupations.

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References

[1] Masum MH, Pal SK, Akhie AA, Ruva IJ, Akter N, Nath S. Spatiotemporal monitoring and assessment of noise pollution in an urban setting. Environ Chall. 2021;5:100218.
[2] Ning X, Qi J, Wu C, Wang W. Reducing noise pollution by planning construction site layout via a multi-objective optimization model. J Clean Prod. 2019;222:218–30.
[3] Patella SM, Aletta F, Mannini L. Assessing the impact of Autonomous Vehicles on urban noise pollution. Noise Mapp. 2019;6(1):72–82.
[4] Tezel MN, Sari D, Ozkurt N, Keskin SS; NeseTezel M. Sari D, Ozkurt N, Sinan Keskin S. Combined NOx and noise pollution from road traffic in Trabzon, Turkey. Sci Total Environ. 2019;696:134044.
[5] Iannace G, Trematerra A, Lombardi I. Effects of nightlife noise in a city center. Noise Mapp. 2021;8(1):228–35.
[6] Barbosa AS, Cardoso MR. Hearing loss among workers exposed to road traffic noise in the city of São Paulo in Brazil. Auris Nasus Larynx. 2005 Mar;32(1):17–21.
[7] Rezaei K, Vadiati M. A comparative study of artificial intelligence models for predicting monthly river suspended sediment load. J Water Land Dev. 2020;45(4-6):107–18.
[8] Gagliano A, Nocera F, Cicero A, Marletta L, Evola G. Mitigation of environmental noise in urban streets through lightweight trans-

parent screens. Noise Mapp. 2020;7(1):57–73.

[9] Ghatass ZF. Assessment and analysis of traffic noise pollution in Alexandria city, Egypt. World Appl Sci J. 2009;6(3):433–41.

[10] Asdrubali F. Noise Mapping: a first balance and future perspectives. Noise Mapp. 2020;7(1):84–6.

[11] Murphy E, Faulkner JP, Douglas O. Current state-of-the-Art and new directions in strategic environmental noise mapping. Curr Pollut Rep. 2020;6(2):54–64.

[12] Lu C, Gao L, Pan Q, Li X, Zheng J. A multi-objective cellular grey wolf optimizer for hybrid flowshop scheduling problem considering noise pollution. Appl Soft Comput. 2019;75:728–49.

[13] Yuan M, Yin C, Sun Y, Chen W. Examining the associations between urban built environment and noise pollution in high-density high-rise urban areas: A case study in Wuhan, China. Sustain Cities Soc. 2019;50:101678.

[14] Jäger D, Zellmann C, Schlatter F, Wunderli JM. Validation of the sonAIR aircraft noise simulation model. Noise Mapp. 2021;8(1):95–107.

[15] Çoban NA, Dalkılıç C, Kaya S, Türkmenoğlu M, Çoban M. Smart solutions for recreational noise pollution in Turkey. Noise Mapp. 2016;5(1):21–32.

[16] Ranpise RB, Tandel BN. Urban road traffic noise monitoring, mapping, modelling, and mitigation: A thematic review. Noise Mapp. 2022;9(1):48–66.

[17] Yildirim Y, Jones Allen D, Arefi M. How does transit-oriented developments (TODs) deviate noise pollution of buildings? A comparative study of TODs and non-TODs. Environ Sci Pollut Res Int. 2020 Jul;27(20):25390–403.

[18] Yang W, He J, He C, Cai M. Evaluation of urban traffic noise pollution based on noise maps. Transp Res Part D Transp Environ. 2020;87:102516.

[19] Nourani V, Gökçekuş H, Umar IK, Najafi H. An emotional artificial neural network for prediction of vehicular traffic noise. Sci Total Environ. 2020 Mar;707:136134.

[20] Munir S, Khan S, Nazneen S, Ahmad SS. Temporal and seasonal variations of noise pollution in urban zones: a case study in Pakistan. Environ Sci Pollut Res Int. 2021 Jun;28(23):29581–9.

[21] Morgan PA, Hothersall DC, Chandler Wilde SN. Influence of shape and absorbing surface-a numerical study of railway noise barriers. J Sound Vibrat. 1998;217(3):405–17.

[22] Singh D, Upadhyay R, Singh Pannu H, Leray D. Development of an adaptive neuro fuzzy inference system based vehicular traffic noise prediction model. J Ambient Intell Humaniz Comput. 2021;12(2):2685–701.

[23] Telfah DB, Louzi N, AlBashir TM. Water demand time series forecast by autoregressive distributed lag (ARDL) co-integration model. J Water Land Dev. 2021;50(6-9):195–206.

[24] De Souza TB, Chaves Alberto K, Andrade Barbosa S. Evaluation of noise pollution related to human perception in a university campus in Brazil. Appl Acoust. 2020;157:107023.

[25] Hammad AW, Akbarnezhad A, Rey D; AHammad AW. Akbarnezhad A, Rey D. Sustainable urban facility location: minimising noise pollution and network congestion. Transp Res, Part E Logist Trans Rev. 2017;107:38–59.

[26] Parvan M, Rikhtehgar Ghiasi A, Yousefi Rezaii T, Farzamnia A. Transfer learning based motor imagery classification using convolutional neural networks. 27th Iranian Conference on Electrical Engineering (ICEE); 2019 Apr 30 – May 02; Yazd, Iran. IEEE; 2019. p. 1825–28.

[27] Nourani V, Molajou A, Najafi H, Mehr AD. Emotional ANN (EANN): A new generation of neural networks for hydrological modeling in IoT. Artificial Intelligence in IoT; 2019. pp. 45–61.

[28] Nourani V, Molajou A, Uzelaltinbulat S, Sadikoglu F. Emotional artificial neural networks (EANNs) for multi-step ahead prediction of monthly precipitation; case study: northern Cyprus. Theor Appl Climatol. 2019;138(3):1419–34.

[29] Bruel & Kjzer. Manual user of investigator 2260. Denmark: Bruel & Kjzer; 2000.

[30] Gupta A, Gupta A, Jain K, Gupta S. Noise pollution and impact on children health. Indian J Pediatr. 2018 Apr;85(4):300–6.

[31] Chahouri A, Elouahmani N, Ouchene H. Recent progress in marine noise pollution: A thorough review. Chemosphere. 2022 Mar;291(Pt 2):132983.

[32] Margaritis E, Kang J. Relationship between green space-related morphology and noise pollution. Ecol Indic. 2017;72:921–33.

Appendix

The text of the Philip L. Rice questionnaire is presented in Table A1.

Table A1: The text of the Philip L. Rice questionnaire

No.	Question text	No.	Question text	No.	Question text
1	Lack of experience and skills of people at work	21	Worrying about losing one's job and being fired	41	Unclear expectations
2	The job is not completely clear	22	Inadequacy of job training	42	Not knowing what to expect from the person in the future
3	Lack of clear expectations from the individual	23	Unfriendly relationship between individual and colleagues	43	Feeling tired when leaving work
4	Uncertain expectations from the person in the future	24	Lack of desire to do work	44	Lack of success and promotion of one's job
5	Inability to please superiors	25	Lack of free time for personal affairs	45	Inadequacy of job training
6	Inability to communicate with superiors	26	Discrimination between people based on age, work experience and education level	46	Participation in work with colleagues
7	Considering a person with little experience and giving him orders	27	Having a busy and uncomfortable work environment	47	Unfriendly treatment of colleagues with the individual
8	The supervisor's favorable behavior with the individual	28	Excessive physical pressure in one's job	48	Feeling uncomfortable while going to work
9	Friendly, reliable and respectful relationship between supervisor and individual	29	Not reducing the workload of the person	49	The complexity of the work is interesting for the individual
10	A tense relationship between managers and workers	30	Fast work rhythm	50	The excitement of one's work
11	Freedom of the individual in performing duties	31	Need to work quickly	51	Diversity of one's job
12	A sense of future assurance by doing this	32	No time off at work	52	Loss of interest in one's job
13	There are many bosses in one's work area	33	Anticipation of breaks in one's work	53	The future of one's job
14	The boss does not care about his job	34	Exceeding the need for work beyond the individual's ability	54	Leaving work feeling tired
15	Appropriate treatment of superiors to the individual's performance	35	Loss of energy at the end of the day	55	Continue working without needing money
16	Superiors not appreciating the individual for his merits	36	Not enjoying leisure time due to loss of energy at work	56	Being involved with work
17	A person's lack of hope for promotion	37	Spending more time at work than others	57	Choosing a person's job again
18	Dissatisfaction of the individual in decision-making and participation	38	Being responsible for many people	-	-
19	Having more education than the work done	39	Lack of support for employees at work	-	-
20	Mismatch between education and job requirements	40	Ineffective support of employees at work	-	-

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