

# Salutogenic design with healthcare approaches to indoor environment for office premises

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**Abstract.** It is statistically proven that a person on average spends about 90% of the time indoors. Therefore, it is not surprising that more and more scientific studies demonstrate that the design, construction and operation of buildings directly affect health. Air, microclimate, water, light, decoration materials - have a powerful effect on both the physical and mental state of people. No company striving for economic growth can ignore the problems arising from the incorrect organization of the workspace, since the internal environment of the premises determines the health of employees, and ultimately the productivity of employees and the company's profit.

## 1 Introduction

According to the World Health Organization, office workers are increasingly suffering from "Sick Building Syndrome" (SBS), which is manifested by increased fatigue, headache, allergic reactions, asthma, and other disorders. In Russia, according to a survey of 2011, 60% of respondents consider their office unsafe and not environmentally friendly (employees of 140 domestic companies took part in the survey).

### 1.1 The trend towards a healthy built environment

Today a new trend is emerging, combining the concept of green design with the idea of preserving and strengthening people's health [1, 2]. When developing architectural projects, more and more architects, designers, and builders strive to take into account not only environmental factors (reduced energy consumption, etc.), but also what impact the design will have on the well-being, mood, and performance of the building's inhabitants [3, 4]. To solve these problems, interdisciplinary teams are created, in which, in addition to architects, engineers, designers, medical experts, psychologists, ergonomics specialists, and others are involved. [5] Advanced companies that equip their offices in this way receive additional profit in connection with increased productivity. For example, Bank of America, thanks to the salutogenic approach, increased labor productivity, which allowed the company to save \$ 15 million a year. In Russia, there are regulatory, technical and sanitary-epidemiological documents (GOST, SanPiN (Sanitary Regulations and Norms)), following which ensures safety for the inhabitants of the building. However, these standards do not take into account many factors that could contribute to better health and increased productivity [6]. Tools are needed to evaluate the health of office workers, the impact of the workspace on the condition of workers and their

productivity. A health assessment will help you understand what measures you need to take to improve your health, increase your ability to work, and increase productivity. Such tools, recommendations and standards are being developed today at the Moscow State National Research University of Civil Engineering and the Institute of Interdisciplinary Medicine [7]. This article presents recommendations for designing an office environment based on a scientific evidence base and research to achieve a synergistic effect [8]: improve the health of office employees, increase their productivity, and also reduce the environmental burden.

## 2 Salutogenic design

The design of the premises affects the general well-being, determines the emotional state of employees, the level of stress and performance. Salutogenic design involves such an organization of space that evokes a sense of well-being, pleases, inspires work and creativity. To ensure this effect, knowledge and a certain skill of architects are required. The sensations and functioning of a person in space are better when the height of the ceilings is combined with the width and depth of the room; the color palette and wall patterns are in harmony with the floor covering and the shade of the ceilings. Carefully thought-out navigation improves the mental state (it should be intuitive, easy to navigate in space). Integration into the design of the nature theme has a beneficial effect on well-being. Biophilic office design increases productivity and creativity by 15%, creates comfort, and ultimately reduces staff turnover, which significantly saves company expenses. Moreover, employees, whose workplaces look out onto nature or trees, take on average 57 hours of sick leave per year, and people without a beautiful view of the workplace take 68 hours a year. And even indoor plants increase work efficiency and satisfaction with their work [9]. (Fig.1) The layout is of particular importance, since visual and acoustic noise during operation significantly affects labor productivity. German scientists conducted a

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study, revealing that during the day at work, employees are distracted by visual interference an average of 600 times, which is about 40 hours a year or 5 workdays. This is especially relevant in the case of open space [10]. The absence of partitions or the use of low structures creates a strong noise background, visually distracts and amplifies computer radiation. It tires people and causes stress. With intense background noise, labor productivity decreases by 66% [11]. At the same time, 99% of employees say that they are most distracted by phone calls from colleagues and outside conversations. The use of special perforated acoustic panels, reflective screens, directing sound waves to the ceiling or into the aisles, reduces the impact of acoustic noise on a person. It should also include areas where employees can socialize in an informal setting. This increases the sense of cohesion by 18%, reduces stress by 6%, and reduces the “turnover” of staff from 40 to 12% (Fig.2). According to research, this increases labor productivity, and allows the company to save up to \$ 15 million per year. Such free communication zones should be calm and comfortable so that employees can concentrate in silence, or collectively discuss work issues, talk in a relaxed atmosphere, present their ideas to colleagues, or simply relax.



**Fig. 1.** Reception of the Institute of Interdisciplinary Medicine



**Fig. 2.** Meeting room of the Institute of Interdisciplinary Medicine.

## 2.1. Daylight

A major factor affecting health and performance is access to daylight. Lack of daylight can cause sleep disturbance, stress, obesity, fatigue, and anxiety [12].

Daylight, a pleasant view from the window, help to improve mental activity by 10–25% and increase labor productivity by 18% (according to Russian data) and 15% - according to foreign ones. Studies show that thanks to bright classrooms with a beautiful view from the window, students receive higher grades and study 20–26% faster, and 20–25% of office workers report a decrease in health problems if their workplace is located next to the window.

However, it is important that the daylight does not cause discomfort, does not overload the visual system. To do this, it is necessary to diffuse lighting using special cover-ups on windows that redirect daylight - this is a simple and at the same time effective way to improve daylight due to the projection of natural light into the interior of the room. You can also install blinds that direct light to the ceiling, reduce glare and reduce the discomfort of direct sunlight.

Computer screens should be positioned at an angle of 20 degrees from the vertical plane of the nearest window so that the screen does not reflect, and employees do not strain their eyes.

## 2.2 Artificial light

Skillful use of daylight reduces energy consumption for artificial light by 40–80%. However, it is important to pay special attention to artificial light, since in the vast majority of cases, electric lighting, unlike natural lighting, provides one level of illumination and color spectrum. This negatively affects the hormonal state of a person, on circadian rhythms - the sleep-wake cycle, which determines the work of the body, affects all life support processes. So, ordinary fluorescent lamps consume alternating current, which causes an invisible flicker - 100-120 flashes per second, which negatively affects vision, causes rapid fatigue and can lead to sleep disorders. According to medical statistics, about 10-15% of adults complain of poor sleep, and 8-12% constantly take sleeping pills.

Today, energy-saving lamps are popular, which allow you to save 50% of electricity (compared with fluorescent lamps). However, the use of these lamps raises many questions because of the mercury content, which belongs to the 1st class of health hazard: negatively affects immunity, affects enzyme systems, causes a violation of hormonal regulation, diseases of the central nervous system, digestive organs, eyes, kidneys, and skin.

To maintain health, it is better to choose lamps with high color rendering index (CRI) and high R9 values — this index affects the transmission of human skin tone, this lamp will display warmer tones, which is more pleasant for the eyes.

In recent years, it is recommended to use customizable LED luminaires, which also consume 50% less energy compared to fluorescent lamps with the same light output, can work together with a lighting control system and reduce the amount of CO2 emissions into the air. Such lamps are able to change color temperature during the day, simulate changing natural light, and also have a built-in system that automatically reduces or increases electric lighting depending on the access of daylight.

In addition, it is important to choose finishing materials for ceilings, walls and floors that reflect and evenly distribute lighting.

Employees can also protect their eyes from computer screens using glasses that block harmful blue light. Or install computer programs that automatically adjust the

light intensity and color rendering of the screen depending on the time of day.

### 2.3 Air quality

Studies show that the air in homes and offices is often more polluted than on the street, because it stagnates in the room and comes in with impurities from the outside. Emissions from furniture, household chemicals, finishing materials are added to it. In 2011, exposure to selected chemicals in the environment and in the work environment resulted in 4.9 million deaths worldwide. It is predicted that in the period up to 2050 the market for chemicals will grow by 3% annually, which is likely to affect the increase in mortality.

Substances such as lead, pesticides, fluorides, benzene, arsenic, formaldehyde are especially dangerous. Moreover, many of them, for example, formaldehyde, according to the Research Institute of Human Ecology and Environmental Hygiene, are almost always present in residential and office premises. Concentrations of hazardous substances (styrene, benzene, ethyl benzene, etc.) in rooms can be 10-15 times higher than safe levels. Studies show that volatile organic compounds (VOCs) and carbon dioxide directly affect cognitive functions, including strategic thinking, creativity, and the ability to quickly and correctly respond in critical situations. In addition, polluted air can lead to various diseases, headaches, office syndrome, allergies, bronchial asthma, etc.

And, on the contrary, high air quality increases the efficiency of employees and work efficiency by 5-10%, and reduces the number of absenteeism by 1/3. US experts have calculated how much this will bring the company in cash, and found that in an office with 100 employees, average annual productivity growth could be about \$ 107,000 per year. And all investments in air purification, installation of air conditioners, reconstruction of premises - will pay off in 12 months due to increased productivity.

One of the easiest ways to ensure high quality indoor air is a good ventilation system and regular room ventilation, which can reduce the level of carbon dioxide and pollutants by several times.

### 2.4 Environmental materials and finishes

Studies on the effects of the environment and building materials on human health and labor productivity have been carried out for more than 40 years, and a number of experiments show that cognitive abilities are 61% higher when working in rooms that meet green standards (VOCs - Volatile Organic Compounds - are reduced approximately up to 50 µg / m<sup>3</sup> and 20 cubic feet of water per person) and 101% higher in rooms that comply with the WELL standard [13].

The environmental friendliness of materials is:

- lack of emission of harmful chemical compounds;
- durability;
- non-toxic to humans and animals;
- use of renewable resources;
- safety for the environment after the expiration of the useful life;
- low energy consumption during production and transportation.

Careful selection of materials is crucial, since indoor air quality is largely dependent on this. When choosing finishing materials, it is important to pay attention to certification, which would confirm the compliance of materials with quality standards.

### 2.5 Healthy food in the office

Lack of adequate nutrition in the office leads to the development of chronic diseases, reduces concentration, increases stress, negatively affecting work efficiency. Conversely, a healthy, regular diet increases the efficiency and productivity of employees.

Studies show that eating habits, although persistent, can be changed in the addictive centers of the brain [14]. To do this, it is necessary to provide employees with the opportunity to eat healthy foods:

- To organize a dining room, creating a healthy diet - for the well-being of employees and increase efficiency, as well as the prevention of cognitive impairment.
- To establish a healthy food delivery system in the office.
- To inform employees about the importance of functional nutrition.
- To provide the possibility of snacks, the ability to heat food, store homemade food.

In addition, in the office it is important to provide employees with access to clean drinking water. Water or its deficiency (dehydration) have a direct effect on memory, cognitive functions and performance. Weak levels of dehydration can cause impaired concentration and short-term memory in adults. Moderate levels - impair memory, arithmetic abilities and psychomotor skills [15].

### 2.6 Office fitness

One of the key factors contributing to the increase in the prevalence of diabetes mellitus, obesity and cardiovascular disease among the urban population today is low physical activity.

Practical solutions of physical in office:

- Office rental near the fitness center.
- Organization of a sports zone with exercise machines in the office itself. The hall should have good ventilation and air purification. There should be a shower.
- If the office does not have a sports zone, it is possible to create conditions for employees to walk, for which, for example, large stairs or long passages between rooms are suitable.
- Creation of places for safe storage of bicycles, or installation of a bicycle parking. However, this solution is only suitable for offices located far from highways and near green forested areas, since cycling or running along busy roads does more harm to the body than good. During physical activity and when running, in particular, huge volumes of air are required to maintain the gas exchange function of the body. The larger the volume, the higher the chance of harmful particles entering the lungs. The constant inhalation of car exhaust can provoke the development of lung diseases, bronchial asthma and lead to intoxication.

Cycling or jogging is recommended no closer than 2 km from the main traffic flow.

- Providing employees with fitness bracelets or installing fitness applications on smartphones that measure heart rate, the number of steps taken per day, calories burned, allow you to track diet, weight and health and can stimulate a healthy lifestyle.

## 3 Stress management room

People - the main asset of the company, and employee illness, fatigue, office syndrome - negatively affect both business processes, profit levels, and the budget, because the employer is forced to pay for bulletins, etc. Therefore, investing in the health and well-being of employees through the organization of a healthy environment will help to increase employee productivity, achieve goals and increase company revenue.

Taking as a basis the biofeedback technology (BFB technology - psychological techniques with which a person learns to understand and control the reactions of his body: blood pressure, muscle tension, palpitations and nerve impulses. Such technologies are very effective in counteracting stress and are becoming more and more popular all over the world). Experts at the Institute of Interdisciplinary Medicine developed a stress management methodology for office workers called "Manage stress", which includes a repertoire of programs and training modules that allows you to quickly recover after an overload or optimize your psychophysiological state before a responsible meeting or complex activity requiring increased mobilization of cognitive and emotional resources in. Employees of such companies can take such trainings in their office in a specially equipped room - stress management room (Fig. 3).



**Fig. 3.** Stress management room in the office of the Institute of Interdisciplinary Medicine.

Stress management contributes to the normalization of hormone levels, the proper course of metabolic processes, which improves mental activity and gives a feeling of mental well-being. The acquired skills of stress management will help to avoid overwork and protect against psychosomatic diseases, activate attention, memory, creative resources; increase the ability to solve complex intellectual problems; improve your mood and appearance.

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