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FROM A TRADITIONAL OFFICE TO HYBRID WORKSPACE AND TELEWORKING: EXPERIENCES PRE-, DURING, AND POST-PANDEMIC PERIOD

Abstract

The paper deals with the analysis of the changes in the working environment, from the traditional offices (conventional workplace), through the hybrid space, up to the virtual environment. The experiences of previous research in different periods, pre-, during, and post-pandemic caused by Covid-19 virus, were used. The focus of the paper are changes in the spatial-functional aspect of work spaces, which arise as a result of the transformation of the of living and working. An overview of reference works that dealt with research in the context of the topic is given.

The aim of the paper is to draw conclusions based on some experiences from different environments about the percentage of acceptance and adaptation to nowadays working environments, supported by information and communication technologies, as well as encouraged by long duration of the global pandemic.

Keywords: hybrid work environment; post-pandemic period; traditional office; teleworking

ОД ТРАДИЦИОНАЛНИХ РАДНИХ ПРОСТОРА ДО ХИБРИДНИХ И РАДА НА ДАЉИНУ: ИСКУСТВА ПРИЈЕ, ТОКОМ И НАКОН-ПАНДЕМИЈСКОГ ПЕРИОДА

Сажетак

Рад се бави анализом промјена радног окружења, од традиционалних канцеларија (конвенционалног радног мјеста), преко хибридног простора, све до виртуелног амбијента. Коришћена су искуства претходних истраживања у различитим периодима, прије, у току и после пандемије узроковане вирусом Covid-19. Фокус рада је на промјенама у просторно-функционалном аспекту радних простора, који настају усљед трансформације у начину живота и рада. Дат је преглед референтних радова који су се бавили истраживањем у контексту теме.

Циљ рада је да се на основу неких искустава из различитих средина донесу закључци о проценту прихватања и прилагођавања на савремене радне амбијенте, подржане информационо-комуникационим технологијама, а подстакнуте додатно дугим периодом трајања глобалне пандемије.

Кључне ријечи: хибридно радно окружење, пост-пандемијски период, традиционалне канцеларије, рад на даљину

1. INTRODUCTION

Initial function of work spaces has changed throughout time, become complex and transformed with regards to the specific requests of business, development and improvement of constructive systems, heating, cooling and ventilation systems, as well as information and communication systems 4.[1]. Industrial revolution radically influenced the change of the traditional office models, while in numerous European countries, there are large administrative buildings which represent the areas for performance of tasks in railway, banking, retail, healthcare, insurance, oil industry and telecommunications 4.[2]. The development of steel constructions and new constructive possibilities has become a milestone in the development of skyscrapers, while the steel construction with huge transparent parts ensured the penetration of great amount of daylight in the internal part of the inner volume, along with minimum need for artificial lighting. This has boosted the possibility of increasing the number of employees in offices, i.e. ensured the possibility to a large number of people to use the same office space.

Particularly important was the release of the space with the appearance of the first system of mechanical cooling in 1900s. The society fully departed from passive models of conditioning of interior spaces for work 4.[2], 4.[3]. The concept of an office was particularly developed with the development of information and communication technologies. This developmental way has dramatically influenced the deletion of borders between traditional cell offices, the appearance of landscape and combined manners of work, final shift of work into the homes and hybrid spaces 4.[4], 4.[5]. It is necessary to take a look at the conditions in the light of the pandemic caused by Covid-19 virus, conditions of visual, audio and heat comfort in the office and during the work from home. The research process indicates numerous advantages and short-ages of hybrid models as the result of pandemic conditions of work, and, accordingly, all realistic parameters of its survival in post-Covid era will be problematized and questioned.

The sustainability of work spaces may be achieved by a multiple approach involving the adoption of new models, along with the respect of anticipations and requests of the users of working spaces, which moved in unconventional, hybrid and home spaces during the Covid-19 pandemic. The purpose of the research is also the identification of working conditions in the light of the pandemic caused by Covid-19 virus.

2. GENESIS OF OFFICES (TRADITIONAL VS. OPEN PLAN VS. COMBI VS. TELEWORKING - HOME HYBRID OFFICE)

Decades ago, the office was transformed into a separate entity denoting spatial, physical and constructed environment in which people perform business activities 4.[6]. Nowadays, office is identified with a random unit, workplace, material entity of an employee, whose position and size depend on the position in the building, work organization and hierarchical positioning 4.[7], civil engineering regulations and socio-cultural values of the relations.

It is important to point out that the labour market has not been facing for the first time the challenges such as pandemic. Along with computerization era during 1980s-1990s and the emerge of e-commerce and the e-business in 2000s 4.[8], 4.[9], the employers faced similar problems of market pressure and resistance of workers due to the lack of acceptance of new business processes. Although the challenge was huge at the beginning, new challenges on the labour market actually contributed to continuous improvement of work processes.

Observing the geneses of work spaces from »cellular offices«, grouped around central atrium or corridor 4.[10], via »open plan offices« or »landscape offices« formed as spaces which negate prescribed conditions for lighting, aeration and thermic characteristics of a space, combined systems of cellular and open plan offices, we have come to »collaborative spaces« which may ensure individuals the opportunity to choose not only the place of work and performance of tasks, but also the conditions and direct interior and exterior environment. Each of these systems has its advantages and short-ages that may be stated, ended up to *teleworking* / hybrid home office.

The treatment of conventional (traditional, cell) work and physical spaces has been the subject of numerous researches in design theory and practice. This issue has been additionally actualized due to the overlapping of Covid-19 pandemic and digital society pretensions. There are plenty indirect and direct factors that influence the change of spatial and functional perception of the working environment. For example, market competitiveness in the light of actual pandemic on the global level has radically encouraged employers worldwide to question conventional paradigms of business process management 4.[11]. Besides that, there is an ongoing issue of the development of

mechanisms for the alignment of human resources with the organization, strategies and goals of business environment 4.[12]. This issue and other ones are frequently related to the limited scopes of conventional, spatial and functional organizations of the working time and attractiveness for the needs of productive professional environment.

Due to the development of technology and science, business environment has evolved in time from precisely defined architectural design principles for specific business purpose to more emphasized resilience and adaptability of large-scale spaces, encouraged by the modern information times. In addition to this, from the aspect of environmental conditions of working space, there are increasingly defined issues such as the criteria of energy performances of a building, acoustic, light and heat comfort, parameters for the creation of healthy work environment, and the like.

2.1. DYNAMICS OF ACCEPTANCE OF WORK ENVIRONMENT CHANGING

The research conducted in the United States among more than 1200 permanently employed workers who worked from home during the pandemic has shown that almost half of examinees want to continue to work from home. More than 45% said that their employers actively think about the follow-up or they are open for this strategy. Among the examinees, 40% regularly worked from home at least one day per week before Covid-19 pandemic 4.[13]. Particularly important research was done by Ipsen and others 4.[14] who analyzed data from 29 countries – experience of the employees (H=5748) during early »lockdown« phases, which they grouped into six key factors that represent advantages and disadvantages of the work from home. Identified disadvantages are the following: work uncertainty, inadequate work tools and limitations of a »home office«, while advantages are: good balance between business and private life, greater work control and improvement of work efficiency.

The genesis of working spaces is done from *cellular - traditional* offices type, grouped around a central atrium or corridor 4.[10]. It leads us to *open-plan offices* or *landscape offices*, which are formed as spaces that negate the prescribed conditions for lighting, ventilation and thermal characteristics of the space. *The combined system* of cells and open-plan offices led us to *collaborative spaces*, that gives the opportunity to choose not only the working place i.e. performance of work, as well as the conditions of the internal and external environment.

2.2. TRADITIONAL, "PRIVATE", "CELLS" OFFICES

Traditional office was a standard way of work organization in companies for long. Closed work stations, »private« offices, »cells«, arranged alongside façade wall, internally connected by longitudinal corridors, in one-fold, two-fold and multi-fold tracts (Figure 1). The lack of operational flexibility in an organization and impossibility for more people to stay in smaller work »cells« and, simultaneously, impossibility of teamwork existence and monotony in the perception of a work place were the main shortages of this type of work organization. The size of a work station necessary for one person in a defined working environment is called spatial density. Spatial density defines the scope of closed work space of a beneficiary and the distance from other beneficiaries 4.[15]. This unit which defined a 1.5m distance was changed during the pandemic to 2.0m distance between two beneficiaries. The shortages of traditional offices are the following: huge part of the space was dedicated to communications and was inefficiently used, more construction material is spent for their creation, more cabling is needed, as well as the need for equipment per offices, difficulties in spontaneous and unplanned communications on joint activities and others 4.[16]. Traditional manner of organizing works spaces followed the era of increased control of work of the workers, and thus the era of more transparent manner of work was accompanied by the development of offices so as to achieve support more innovative and fluid manner of work, connection, interaction and cooperation 4.[17]. Technological progress was accompanied by the arrangement of architecture and interior. Conversely, during the pandemic, traditional offices have proved to be the most secure from the aspect of social distancing of the population, zoning and arrangement of work positions 4.[18].

The traditional office was the primary type of work organization for a long time. Closed work units, "private" offices - "cells" are distributed along the envelope of the building, connected along longitudinal corridors, in single, double and multiple tracts (Figure 1). Such offices are characterized by inflexibility in the organization. Also, it is not possible to increase the number of employees or make a different functional organization inside single "cells".

The position of the body during work, dimensions of the furniture and equipment are defined by the size of the workplace and the required area for performing work tasks. The size of the workplace

needed for one person in a defined work environment is called spatial density. *Spatial density* defines the range of the user's closed workspace and the distance from other users 4.[15]. If we consider that the design module defined for the business facilities is M 7.5, we can anticipate the necessary office area for one, two and more workplaces, as it is done in Figure 2. As the spatial density changes with the pandemic emergence prescribed distance between employees is more than 2 meters. It means that office reorganization in terms of the new disposition of furniture and equipment is almost impossible. The introduction of screens and shift work, with much better control of the microclimatic characteristics of individual cells, with less circulation of the number of employees, are optimal solutions for pandemic working conditions.



Figure 1. Functional tract of traditional "cell" office system: a) single tract b) double tracts c) multiple / three tracts d) multiple tracts

The building envelope is the primary element for achieving lighting (visual) and thermal comfort. It is part of the building front, that is located between two constructive elements - column or wall and two slabs. The construction with columns fully enables the release of the building envelope as an independent element of the construction / assembly, with the implication of ecological, sustainable and bioclimatic parameters. The depth of the room (tract) influence intensity of daylight per room depth. If the space is designed with the constant ceiling height (height from floor to ceiling), as well as the position and surface area of the window, the change in the depth of the room will also lead to the change in the intensity of the daylight by the depth of the office.

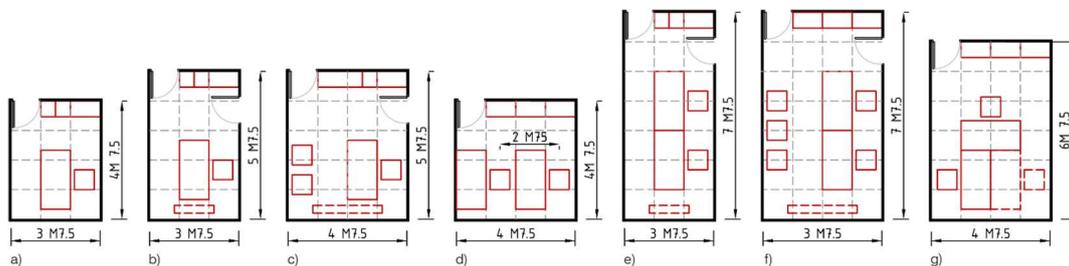


Figure 2. Dimensioning and organization of "cell" offices in relation to the number of workplaces: a) office with one workplace b) office with one workplace and internal communications c) office with one workplace, internal communications and space for clients d) office with two workplaces e) office with two workplaces f) office with two workplaces, internal communications and space for clients g) office with three workplaces etc..

The traditional work units are unchanging and monotonous. It is not possible to organize team activities, spontaneous and unplanned communications at joint activities, etc. Gou 4.[16] states that the disadvantages of traditional offices is inefficient use of communication space, which takes a

large part of the office area. As a result, the quantity of built-in construction material is greater, as well as for equipment needed per offices.

The »I« space in the office, dedicated to individual work, has been gradually re-placed by the »WE«, so its ratio of 70-80% was reduced to 20-30% 4.[19]. Office design was supposed to be adjusted to new requirements of the beneficiaries and space transformations, so the traditional »cellular« manner of work was very soon substituted by collaborative and open one, with the excuse that the work is done more efficiently if the space is more transparent. New manner of organization of a workplace encourages interaction and socialization instead of unplanned encounters. The position of work stations alongside the office and the use of the full space of the office is the concept that has initiated the development of an open plan city 4.[1]. Overemphasized concept of the open plan offices, with the tendency to ensure as many work stations as possible within the assigned spatial frameworks, with fully transparent facades of strict rectangular forms, was particularly developed after the Second World War 4.[20]. Despite being flexible in organization, work spaces have become noisy anonymous rooms, overwhelmed with the clamour of the employees and the noise produced by the work equipment 4.[21].

2.3. FROM OPEN TO COMBINATED AND COLLABORATIVE OFFICES

Driven by innovation and efficiency, the office represented a measure of class affiliation, position in the company, and relationships with other employees on similar or the same work assignments. Social interaction was prohibited and employees were kept in separate rooms. In traditional organizing of work spaces, the control of workers was increased. New more transparent way of working was followed by the development of offices, supported by more innovative working solutions, connection, interaction and cooperation 4.[17]. The new office design encourages interaction and socialization, unplanned meetings and encounters. The Oriel Chambers (Liverpool) can be considered as a milestone in development of skyscrapers and a more transparent way of work organization (Figure 3.a.). The steel construction, curtain wall and large spans allowed the unhindered penetration of natural light with minimal need for artificial lighting (Figure 3.b.).

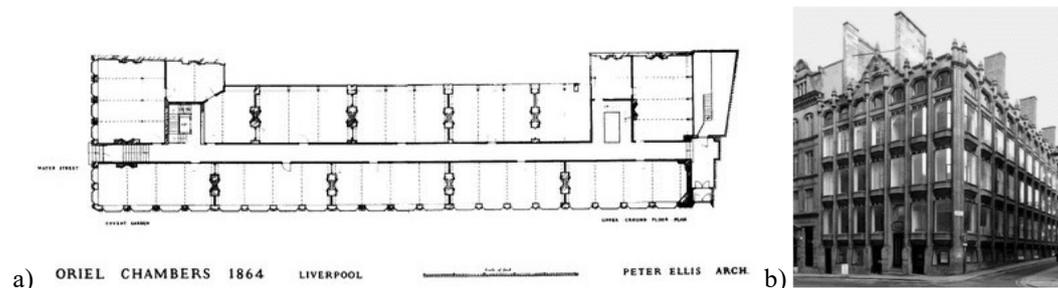


Figure 3. a) Floorplan of Oriel Chambers, Peter Ellis (1805-1884) 4.[22] b) The first curtain wall on Oriel Chambers in Liverpool, Peter Ellis (1805-1884) 4.[23]

The positioning of workplaces according to the depth of the office and the use of its full area initiated *open plan* buildings development 4.[1]. Technological progress was accompanied by improvements as well in interior design. A step further was architect Frank Lloyd Wright's Larkin Building (Figure 4.a.). Employees were placed in the atrium of a six-story building, facing the same direction, in a dark space with artificial lighting (Figure 4.b.), machine conditioned with recycled air 4.[24].

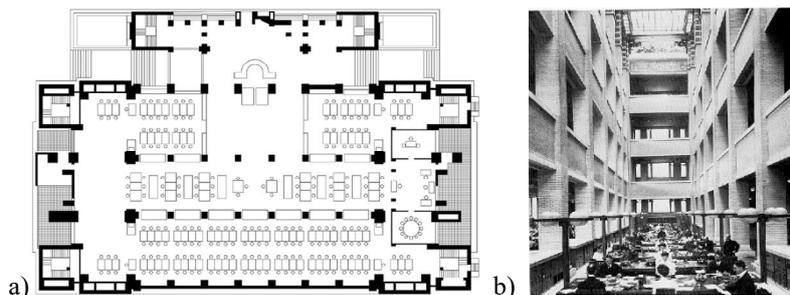


Figure 4. a) 1st floor layout for Larkin Building (1904-1945), Frank Lloyd Wright 4.[16] b) Open plan offices in the atrium of Larkin Building (1904-1945), Frank Lloyd Wright 4.[20]

Open plan office (Figure 5.b) is a large office surface without partition walls. The space is equally available for all beneficiaries, while the zoning is achieved by covers, cupboards, tables, constructive elements and decorative interior elements. Dimensions and openness of the work space are defined by the ratio of the total surface of available space against the total length of its internal walls, including the covers and transparent barriers 4.[25]. By the use of cooling chambers in 1930s and fluorescent lighting in 1940s, the depth of the office tract was not anymore conditioned by daylight and natural ventilation 4.[26]. Exoskeleton and buildings with lateral communication nucleus have ensured fully flexible interior spaces on the floors, without respecting the need for day-lighting, humans as the benchmark, creation of small communities in which the beneficiaries feel comfortable, consideration of environment, aeration and the like. The challenges of additional cooling and ventilation of the space, as well as the placement of cables, emerged with the networking, so this type of offices had to find new architectural, more expensive and less flexible solutions.

Bernstein and Waber 4.[27] in their article »Truth about open plan offices« analysed facial expressions of the employees and their interaction by the use of sensors for monitoring eyesight. They discovered that the interactions of people »face to face« decreased for 70% when companies shifted from traditional to open plan offices, in favour of electronic interaction via computers. Virtual space has replaced physical one, while the reduced privacy lowers interaction of the employees and proxemics. It was in 1990s when the standards for architectural design of business buildings emerged, when the grounds with limited tract depths were designed, with prescribed amounts of daylight and possibility of observing environment from the work station 4.[28], which makes the employees less frustrated, more patient and productive and in better health conditions 4.[29]. This puts aside the design of façade shell as the element of control of a heat and visual comfort and its significance in early phases of architectural design, emphasizing HVAC systems that will »replace« these shortages 4.[30]. Still rigid and orthogonal arrangement of workplaces did not allow individuals to have a personal impact and to adjust the work station to a specific beneficiary. Calisi and Stout 4.[29] state that noise is the greatest problem of the open plan offices, accompanied by visual openness/the lack of privacy, temperature and air quality. They came up with the conclusion that the employees lose even 86 minutes on a daily basis being obstructed in work by the noise made by voices, equipment, HVAC system, mobile phones, etc. which obstructs analytical thinking or creativity 4.[31]. Diskette Behavioural Research 4.[32] conducted research with 2660 examinees, related to their current and wanted working environment in order to identify a work position in future. The greatest number of the examinees (35.5%) favoured traditional closed offices compared to the open plan offices (23%) and the offices with one work station (18.1%). The number of those who opt homes as the working environment should not be neglected (17.4%), as well as those who would choose unconventional spaces such as cafés (6%), which indicates that the work is increasingly perceived as a flexible category in terms of the location. Studies have shown that the productivity of employees decreased for 14% by movement from cellular to open plan offices, initiated by high level of noise. The movement of the employees from the open plan into cellular offices resulted in the increased productivity for 16.9%, while the shift to individual work spaces resulted in the increased productivity for 21.9% 4.[33]. Drawing attention of an employee from the assignment which requires concentration at work is closely related to the level of noise in the working space.

At the end of 1950, landscape office system became developed. Seemingly chaotic configuration of desks and space for the employees was designed on the basis of work formats, ergonomics of employees and the work done 4.[34]. Fully airconditioned internal space was developed in 1970s into the system of office cabins accompanied by cubic forms of modular furniture system 4.[17]. Such space is characterized by nonhierarchic exchange of information and knowledge, better contact of the employees, changeable and adaptable functional organization and furniture. These typologies change the way of thinking, the employees do not have their own territory and thus they do not have responsibility, all problems of open plan offices become vivid, with particular emphasis on ignoring psychological aspects of the employees 4.[35]. This manner is very similar to today's co-working spaces. The space is fully mechanically air-conditioned, while in the 1970s it developed into a system of office cubicles, as well as the cubic forms of the modular furniture system 4.[17]. In this manner employees have their own personal / private space, with more adaptable functional organization. A step further is the organization of the furniture and equipment necessary for joint work placed in the central part of each floor 4.[28].

»Democratization« of work spaces was done only in 1980s and 1990s, when cellular type of workplace organization became transparent and further organized alongside façade shell, but also

grouped around the central zone which contains furniture and equipment necessary for joint work 4.[28]. In this way, the surplus of equipment is excluded from the space of permanent stay of the employees, became centralized, which facilitated air-conditioning of the space, reduced costs and required infrastructure.

Combi office (Figure 5.c.) is a solution which combines all advantages of cellular and open plan offices, balancing appropriately the ratio between joint spaces and spaces for individual work. A step further was also made in the control of the lighting. The control of lighting is frequently done on the level of a work unit, from the desk, which resulted also in energy saving 4.[36]. Localized controls of lighting and air-conditioning are positioned on the desks of the employees and, thus, they do not need to leave the work station. Localization of the control excludes the use of sensors and negatively influences uniformity of the background and image in the whole space 4.[37].



Figure 5. The genesis of workspaces a) traditional system in three tracts b) open plan office / open system c) flexible - combined system

With the advent of portable devices and computers, the office becomes virtual, changeable, and the employee is freed from time and place. Smart use of information technology resulted in a series of alternative solutions that ranged from telecottages to working in alternative places, such as coffee bars 4.[28]. The theory also developed is: »Your Office Is Where You Are« 4.[24]. Work is based on activities and changes at an accelerated pace, and no one has a fixed job position, which supports the vision of a polycentric city. Professional and freelancers of similar interests began to join together around the same space, sharing costs and giving each other professional support. That's how *collaborative work spaces* were created.

Collaborative work spaces are created by six factors, such as: transport, size of a city, sustainability, technology, demography and cultural and sociological characteristics 4.[17] »The third place« 4.[38] might be found on several locations, it is closer to the place of residence and is not a formal office. More agile corporate mechanism opts for »outsourcing«, much more taking into account security and health of the employees due to everyday commuting 4.[39]. Corporate hierarchy hardly exists, but in collaborative spaces everyone has their own desk, with the focus on the work they perform. These spaces have actually been made as the link between conventional and unconventional work spaces, so we have all become freelancers due to Covid-19 pandemic. Landscape and collaborative spaces have been replaced by isolated private cabins 4.[40], covers, which simulate transparent walls of independent work units.

Collaborative work spaces are based on 4 sustainability perspectives such as: new work (flexible access to the space and resource sharing), incubator (togetherness), social responsibility towards resources (sustainable and effective energy consumption) and environmental responsibility (focus on environment factors) 4.[41]. As opposed to home conditions, collaborative spaces positively influence social interaction, exchange of knowledge and individual creativity of associates 4.[39],

supported by actions that contribute to the sense of community, support, encounters and engagement. This model has fully denied the concept of cellular offices, building a community for uncertain future. Under pandemic circumstances, their functional organization would have to be examined, as well as the possibility of aeration, the possibility of daylighting and the environment would have to be considered, as the redefining of management aspects in order to actively use mediation mechanisms via digital interaction 4.[42].

Remote work has been accompanying the development of digital technologies for ages, which has largely contributed to the changes in work organization 4.[43], both on local and international level, satellite offices or work from home due to the impossibility to come to work 4.[44]. Remote work is closely related to the knowledge of technology, and, before pandemic, it was strictly related to high-tech companies 4.[14]. Since the outbreak of Covid-19 virus, remote work was accompanied by accelerated technological education of the employees which depended on the motivation and predispositions of individuals, as well as the ownership of one's own computer for performing the work from home. In addition to this, the creation of virtual office space tests new relations such as: organization culture, communication and cooperation 4.[45]. Compared to the virtual work, office work increases the control of work and reduces potential risks of work activities 4.[46], and thus the responsibility of the employees. The employees have better support in work when in office, they are not isolated and they have better access to information 4.[47], while the virtualization of the workplace should be retained as the support to the employees. New generations of »digital aboriginals« have been increasingly directed towards the use of technology and this additionally prevents their social integration beyond Internet 4.[48]. Shrivastava and Singh 4.[49] emphasize the consequences of working virtual space, both in behaviour and in the organization itself, since the employees lose critical talent, intellectual and physical property, they stay in non-simulative working environment, they are under stress and they don't balance work and life obligations properly.

2.4. SUSTAINABILITY OF TELEWORKING

The number of people who worked from home increased radically during the pandemic 4.[14]. Teleworking was mostly implemented during the lockdown period, and the practice continued even after restrictions were lifted, albeit on a smaller scale. Remote work has been accompanying the development of digital technologies for ages, which has largely contributed to the changes in work organization 4.[43], both on local and international level, satellite offices or work from home due to the impossibility to come to work 4.[44].

The Covid -9 pandemic was accompanied by accelerated technological education of employees, and new relationships such as organizational culture, communication and cooperation. Employees are without colleague's support, access to information is poor, and they rely on their own computers and equipment, and an individual sense of responsibility. Working from home becomes unstimulating, critical talent is lost, and balancing proper work and life obligations is not possible 4.[49].

In May 2020, we conducted a survey with 34 combined questions. An anonymous questionnaire was conducted online on 202 respondents, mostly employed in the administrative sector (banks, ministries, schools), in the territory of Podgorica, the capital of Montenegro. The survey also contained a question that referred to highlighting the desired way of working after the pandemic. In less than a year since the start of the pandemic, the percentage of employees who want to return and do their work exclusively in offices has increased by 54%. The rest are willing to continue working in a combination, in the office and from home, while no one expressed a desire to work exclusively from home. The reasons for returning to the office are different and range from: noise levels in the home due to the overlap of family and work environments, blurring of boundaries between business and private obligations, functionally unsuitable work spaces, bad psychological impact due to additional stress due to sharing the work space with family members, quality of work performed, productivity, impossibility of consultation with colleagues, poor IT training, tension and the like. These results are not in favor of the teleworking model of work in the post-pandemic period, which can be of key importance for directing the optimal working conditions after the pandemic, not only in the territory of Podgorica, but also more widely.

3. HYBRID WORKSPACES ENVIRONMENT: ARGUMENTS FOR ADAPTING ORGANIZATIONAL STRUCTURE

The working surfaces, as well as the number of employees at one working space had a great influence on the dynamics of business operations during Covid-19 pandemic, and they are one of

the key parameters of this research. Taking into account the basic that anyone who had contact with infected persons must be in isolation, it can be concluded that although smaller spaces in which it was impossible to achieve physical distance prescribed by the measures, potentially were more favourable for the transmission of the disease, huge working spaces with larger number of employees had greater negative consequences, due to more frequent and forced isolation of the whole team, and therefore the work moved from the office space into the private one – work from home.

Today's work is not necessarily bound to physically completed work space. Digitalization era encourages the idea that a workplace may become any space within which we deal with working assignments. Freedom and flexibility in the perception of the work space do not adhere to architectural principles and practices, since the beneficiaries frequently go into extremes, and thus almost each environment and each time have become adequate for work [4.50]. In favor of this statement is the fact that in 2014, the Bureau of Labor Statistics recorded 14.4 million self-employed [4.51]. Thus, in America, the number of self-employed increased for 80% in less than 10 years [4.50]. Although this manner of work contributes to greater flexibility in the organization of a working time, greater autonomy and the sense of freedom, there is no doubt that this manner of work fosters the sense of isolation [4.52] due to limited social engagements.

Employees are not willing to continue working only from home. Employers are challenged to bring employees back to the office, by resorting to new organizational schemes, in a more productive and stimulating work environment. In their book »Design for Sustainability« [4.53] sustainability is an approach to architectural design, which offers a wide range of new design inputs, such as: environmental efficiency, responsible, holistic, contextual, restorative, visionary and synergy design, along with solving the problems such as comfort, aesthetics and costs. New standard in the design of offices is increasingly closer to the cellular type, since again the accent is put on »I« space against the »WE« space [4.19], so the combination of these two principles may be regarded as optimal in pandemic conditions.

A common sense should be the guide for the return to the post Covid-19 office, and design should that premises. Some of the inputs should be:

- Lebowitz [4.54] gave 10 usual ways big office could change in a post-covid world, such as: mudroom, baristas and community kitchen, collaborative corridors as dynamic and programmed spaces together with open collaboration spaces and virtual collab spaces (with a green virtual wall). Special focus is on the treatment of workstations that are more as elbow room and intimate scale. while the office becomes office – not quite and cubicle as an cell office, but with the possibility to stop by and say hello, as well as the spaces with neighbourhood configuration (Figure 6);

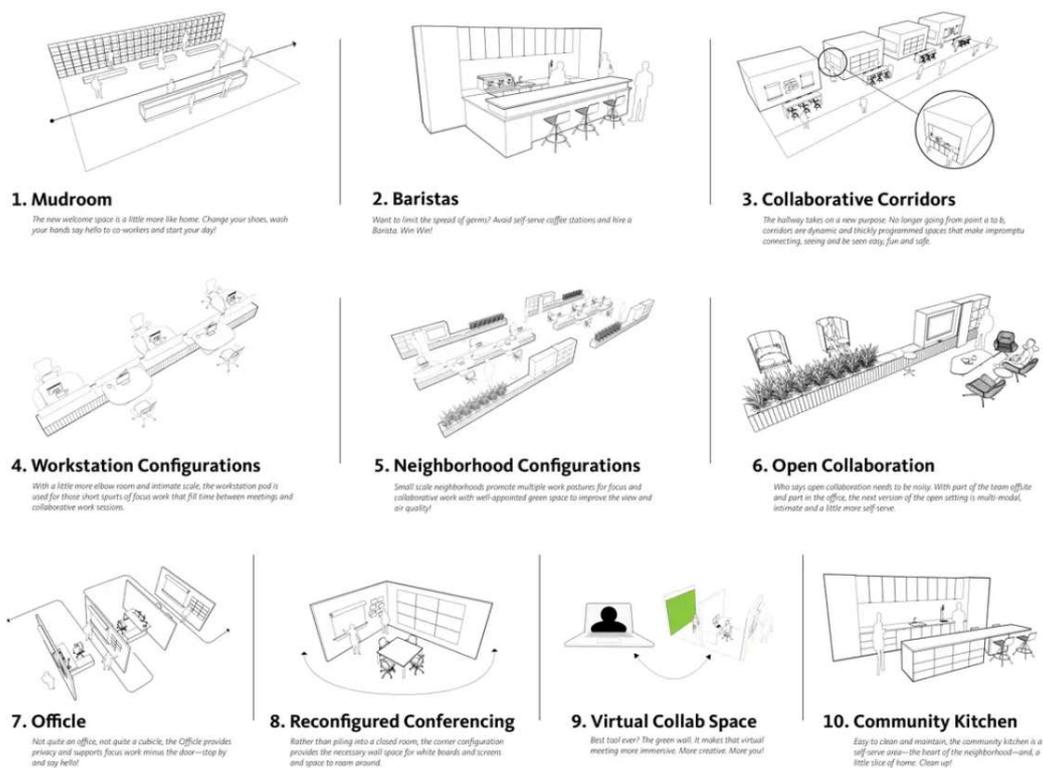


Figure 6. 10 usual ways big office could change by Lebowitz 4.[54]

- office should be done by the new layouts, that pay in attention safety, cognitive, emotional and physical aspects;
- Fixed vs. Fluid - open collaboration space. As social gardens the office should be a meeting space, but not too open. Work in office gives and opportunities for collaboration with colleagues. Open space encourages the feeling of belonging and connection with the collective, but it should also be more space for continued social distancing when needed 4.[55];
- biophilic design elements means it should bring in natural elements in the office (Figure 7). Offices go literally green. The assumptions are that employees after months of closure want an open space, so the presence of plants would increase lighting, a more pleasant atmosphere, the presence of natural colors and materials 4.[56]. It should enable connection with nature, setting up micro green micro points or open spaces with facilities for employees to stay;



Figure 7. Examples of hybrid nowadays offices 4.[57]

- Me vs. We- placement of "I", as well as "WE" space, where staff could be alone or relax, or organize meetings. The space should be acoustic, private, comfortable, built with every feature needed for successful video conferencing 4.[56]. It should also be: safe in materials

(anti-virus solution), flexible (easy to install and lightweight), acoustic protected, ergonomic and functional adapted to different needs for work or rest. Office would be designed as a balance physical and virtual work. They include the Pop-Up Meeting space with small rooms and demountable walls 4.[58];

- miss office noise the acoustic design approach in the post pandemic scenario;
- offices should be flexible for different uses;
- Open vs. Enclosed - designing neighborhoods at work (Figure 8, Figure 9). New office should be easily changeable and have macro “locations”, that makes indispensable for the employee with a home office etc. 4.[58] The work reality will change old patterns and behaviors, as well as people want their workplace to be more humanized which means the office needs to adapted to a new set of needs 4.[59]. Office should be “our neighborhoods where we live, learn and grow”, that is also diverse, inclusive and resilient.



Figure 8. HushHybrid office call for one person and An office meeting pod seating 4 4.[58]

- it should also have “parks, plazas and cafes” 4.[59]. Office should not be assigned the same type of space, can be shared, multi-modal spaces, easy to switch from individual focus work to collaboration and socialization;
- Braiding Digital vs. Physical Experiences - is based on that are highly flexible and support a variety of types of work within one setting. It should be able for future changes. Technology and space should be in line and holistic.
- hybrid work should strive for engagement and ease 4.[59];
- assigned homes - welcoming section and office first impression (Figure 9). It gives home belonging feeling; you can change your clothes or shoes and be introduced to the upcoming obligations;
- office should be adaptive even in the scale of office furniture. It should be multifunctional, movable in order to increased collaboration between workgroups and designed for multi-generational.
- office should be smart in sense of technology. Hands-free technology reduces the spread of virus due touchless technology. Technological advances should keep pace with the development of offices and the demands of employees. Hybrid office design one step ahead technology progress and trends in companies that continuously evolves. It should follow ever-changing consumer expectations.

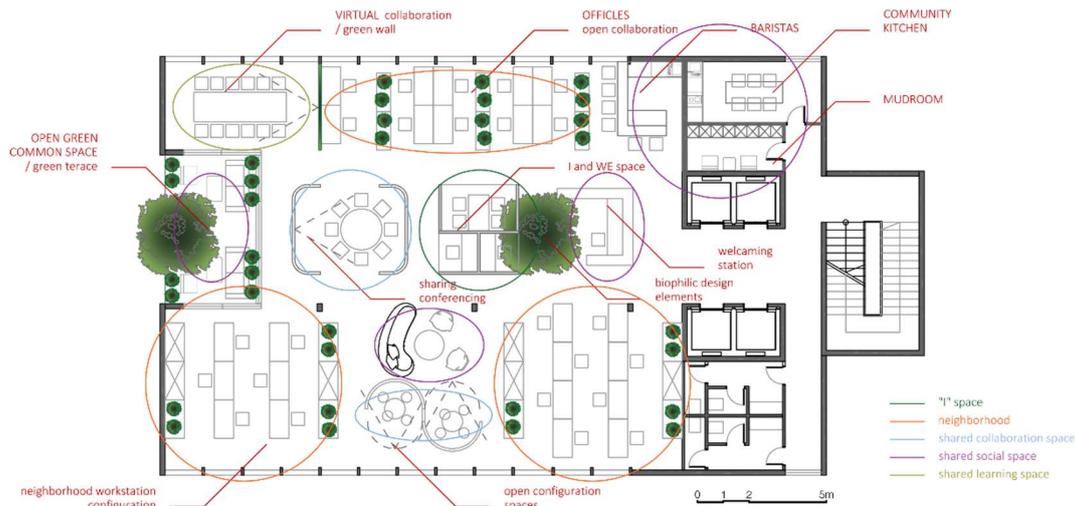


Figure 9. Hybrid workplaces - an example of the office transformation from 2.3. Figure 5. with macro "locations" with various contents needed during work and rest at work

4. DISCUSSION AND CONCLUSION

Covid-19 pandemic has had impacts on all segments of life, in which individuals were forced to change their regular way of living and work, due to the basic prevention measures based on physical distance. This has been predominantly reflected in the work space, which entails contacts with other people, and which has led to the change of traditional office models or in open systems – collective office. Under Covid-19 pandemic conditions, the work is not primarily related to physical and office framework anymore, but to the spaces that we regard as comfortable, functional working environment, authentic and specific for each individual. In this way, working space loses the limits of classical work space, and it has to be the space for rest, the space for creative activity, not rarely recreation and amusement, fully reorganized in a more radical and hindering sense [2].

Recently established co-working was created as the "third location" [51], which offers to the employees of related spheres of interest the opportunity to be nearby their residential spaces, but in an alternative environment which has better working attributes such as internet connection, technical support, information system security, assistance from other beneficiaries and socialization [3], [4]. This has also influenced partial modification of life spaces, while the beneficiaries were forced to partially adapt their life spaces to the working ones. It is exactly this type of departure from traditional cell offices, which consequently causes the transformation of life spaces, which is at the same time the focus of the research. The research is based exclusively on the adoption of attitudes and conclusions on office models during Covid-19 pandemic. The goal of the research is determination for optimum model of productive work space in post-pandemic period. It should be hybrid office type that respect safety, cognitive, emotional and physical aspects of users. It is also flexible in the term of space and furniture, with biophilic design elements. New office should be welcoming, designing in the manner of neighborhoods at work, assigned homes. It should be assigned as city with multi-modal spaces such as parks, plazas and cafes, that follows technology progress. It should respect "I" needs, as well as "WE" requirements.

This model has fully denied the concept of cellular offices, building a community for uncertain future. Under pandemic circumstances, their functional organization would have to be examined, as well as the possibility of aeration, the possibility of daylighting and the environment would have to be considered, as the redefining of management aspects in order to actively use mediation mechanisms via digital interaction [59].

On the basis of numerous collections and systematization of literature, this paper provides an overview of reference research in the context of the topic, which may be of importance for further research.

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