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Office-Nature Integration Trends and Forest-Office Concept FO-AM

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Abstract – For sustainable development, it is important to ensure healthy life and well-being for all ages, promote inclusive and sustainable economic growth, productive employment and decent work, take urgent action to combat climate change and its effects and protect, restore and promote sustainable use of terrestrial ecosystems. Taking into account the negative effects of climate change, the degrading effects of contemporary conventional industrial scale agricultural practices, the declining everyday physical activity of the working age people in developed countries, and other problems related to indoor work, this research proposes the office concept entitled FO-AM (*Forest-Office Administrative (function) Movement*) that allows to gradually move from sitting to walking while working in purposefully created or adapted forest areas. Numerous studies have been conducted on the positive effects of the natural environment on human health and productivity. A study published by Australian researchers revealed that sitting time is directly linked to all-cause mortality. While research results call for effective innovations for reducing the amount of time spent sitting and encouraging people, especially urban residents, to connect with nature, no effective holistic solutions have been found yet. The article presents a literature review on the contemporary office-nature space integration trends and the existing technical and design solutions and contemporary re-naturalization practices of ex-urban areas and presents the conceptual idea of landscape technology FO-AM allowing to transfer the functions of administrative buildings to the semi-natural and natural environment, including partially anthropogenic environment, park, forest park and natural forest, and in this way to address public health and well-being, economic innovation and climate change issues, thus contributing to the long-term sustainability goals.

Keywords – office, office-nature integration, forest-office, FO-AM, re-wilding, terraforming

INTRODUCTION

As it was stated by the United Nations 2018 Revision of World Urbanization Prospects, 55 % of world population resided in urban areas in 2018, and it is estimated that the figures can reach up to 68 % in 2050 [1]. In the recent years, with the increase of urbanization, people started to demand the need for being in contact with nature even more than before, and workplaces, including the office spaces, are not exceptions, too. Currently workplaces are one of the most common types of physical environments that individuals inhabit in their daily lives [2], and thus office concepts and approaches to work organization are likely to influence not only the effectiveness and profitability of organizations, the national and international economy, but also public health [3]. A study published by the Australian researchers revealed that sitting time is directly linked to all-cause mortality [4]. While research results call for effective innovations for reducing the amount of time spent sitting and encouraging people, especially urban residents, to connect with nature, no effective holistic solutions have been proposed yet.

The aim of this research is to provide the general concept for gradually re-settling office function to forest areas outside the cities, thus contributing to the climate crisis solution, benefiting the human health and also raising productivity of office tasks performance. Some studies suggest that high density built-up fabric concentrating variety of urban functions failed both preventing urban sprawl and ensuring preservation of natural ecosystems outside of the urban areas [5], [6]. Therefore, other tactics and strategies integrating natural, anthropogenic and technological environments are required to design sustainable future of our planet. The FO-AM (*Forest-Office Administrative (function) Movement*) is a highly futuristic approach and is based on the idea of total heritage that aims both to connect between the deep past and distant future [7] as well as between some positive aspects of society of wanderers and sedentary society [8]. Several studies that aimed to scan horizons of the future urbanism succeeded to argue that future towns will be based on small scale, merging together nature and culture, biology and technology [9], [10]. Methods of the research include the review of literature that regards nature-related aspects of the office space organization, office workers' health issues and degraded landscape reclamation trends. In order to forecast the FO-AM as possible and the fittest time arrow for the near and distant future of both office space organization and city re-designing, we use the horizon scanning method, which is based on the inversion of the results of current observations of reality.

I. LITERATURE REVIEW

The analysis of literature using Scopus and Web of Science databases, Google Scholar and other search engines has revealed several directions of current research related to the forest-office concept: 1) research on the positive impact of the natural environment on human health and work productivity and integration of the elements and features of natural environment in the architectural solutions of working environment; 2) health problems caused by sedentary work in offices and the resulting need to change the nature of work organization and experimental architectural proposals related to this need; 3) rehabilitation of abandoned or agriculturally degraded suburban and ex-urban areas with the potential of FO-AM concept development. Indeed, the regions, where the demand of agricultural production is very high, suffer and in the future will suffer much more from the pollution related to farming activities, from excessive use of pesticides and herbicides and soil depletion and degradation, which causes negative impacts on the overall ecosystems and cli-

mate [11], [12]. Since the resources of arable land in 2050 will decrease to one third of that in 1970 [13], it is evident that re-wilding, reforestation or even terraforming would help to restore the soil and landscape, and that alternative uses of these areas must be envisioned. Meanwhile it can be expected that agriculture will be cultivated in controlled vertical farms. This would allow to shorten the chain of food supply as well.

Positive impact of interaction with nature and office-nature integration trends. Numerous studies and literature reviews demonstrating the positive effects of interaction with nature on human physical and psychological health and work productivity [2], [14]–[21] were identified. This area of research was started in 1980s, when the research by R. S. Ulrich [14] demonstrated that vegetation and water views tend to attract and hold human attention more than the views of urban scenes. In 1984, R. S. Ulrich identified positive impact of nature views on the recovery of patients [15]. M. S. Abdelaal's literature review has demonstrated the advancements in this research field in the recent years: the connections between exposure to nature and restoration of attention, reduced mental fatigue, better learning outcomes, task performance and cognitive performance improvement, higher work productivity, improvement of concentration and memory and even positive effect on inspiration [19]. Recent studies have demonstrated positive links between perceived naturalness of environment and the place attachment as well [20]. There is so-called biophilia hypothesis [22], developed at the same time as the works of R. S. Ulrich on the restorative capacity of nature, which states that a positive emotional response to natural environment in humans is inherent in nature and determined by evolution. This hypothesis argues that “because so much of our evolutionary history was spent intimately living in and interacting with nature, a need to connect with nature persists to this day” [2]. From this hypothesis arose the concept of biophilic design [23], which integrates the features of natural environment into the human living and working environment. Positive impact of nature on health and productivity and especially on mental health currently are of crucial relevance. According to K. McEwan et al., currently mental health issues affect more than one in six people across the European Union; in the United Kingdom mental illnesses is the most common disability. They note that nature-based solutions, such as Japanese forest bathing woodland walks, are being applied to tackle this mental health crisis [16].

From the perspective of biophilia hypothesis and the reviewed research, by providing opportunities for office workers to connect with nature at work should make them feel happier, be more productive and creative [2]. It is not surprising that the elements and features of natural environment are increasingly integrated in office design for employee health, productivity and creativity [24]. Innovative activities in this field include prepared and implemented office buildings and work environment projects. These projects can be divided into several categories:

1. Bringing qualities and features of nature into urban environment, integrating into existing office typology both in interior and exterior solutions: green outside and inside walls, interior vegetation and indoor parks, natural ma-

terials, imitation of the qualities of natural environment with space arrangement solutions, etc.

2. Bringing office buildings into natural settings in large and small scale: large scale offices in forest settings, small scale transparent buildings providing direct visual contact with nature.
3. Integration of both above-mentioned categories.

The overview of publications in popular business and architecture websites gives the impression that forest and office integration is currently trendy. The headlines such as “Office in a forest: is this the workplace of the future?” [25] or “Why your office is beginning to look like a forest” [26] can be seen as forecasting the change in the office work culture. However, the reviewed office-nature integration trends still do not reveal any radical change in the ways how the office spaces and work in them are organized.

Health damage of sitting and the need of the shift in the office work culture. Health problems caused by sedentary work have been addressed in many scientific publications [27]. For example, the study by Australian researchers published in 2012 found that sitting time is directly related to all-cause mortality. Long sitting time has possible associations with increased risk of obesity, cardiovascular disease, diabetes, and cancer [4]. Moreover, recent research demonstrates that even regular physical activity cannot offset the detrimental health consequences of prolonged sitting [28]. According to A. Biswas et al., health programs are usually focused on the promotion of physical activity; however, these findings demonstrate the need of advocating for a reduction in sedentary time [27]. This aspect is more challenging as it requires to change the culture of behavior. According to L. R. Renaud et al., contemporary innovations in the office spaces intended to reduce the time of sitting include interventions aimed at reducing the use of chair and subsequently reducing sitting time, increasing movement or standing time. They note that standing time has been inversely associated with all-cause mortality [29]. Thus, standing can be seen as an alternative for sitting in the workplace. This has led to the development of the experimental office environment where sitting is not encouraged. Such a solution, called “The End of Sitting”, was developed by Rietveld Architecture Art Affordances (RAAAF) and is currently in the prototype phase, undergoing pilot studies [28]. This includes the experimental furniture-sculpture that allows different positions while working. However, these prototype solutions give impression of fully artificial environment and do not provide the beneficial connection with nature.

Re-naturalization, re-wilding and terraforming – the landscape dimension. Analyzing the office-nature integration possibilities, another relevant issue is the re-naturalization of suburban areas (abandoned or degraded by agriculture [11]–[13]) and their adaptation to sustainable use. Re-naturalization research currently attains increasing attention in the face of ecological and climate crisis [30]. Re-naturalization can be spontaneous or purposeful [31]. In the recent article published in The Science journal A. Perino *et al.* underline that “humans have encroached upon a majority of Earth's lands. The current extinction crisis is a

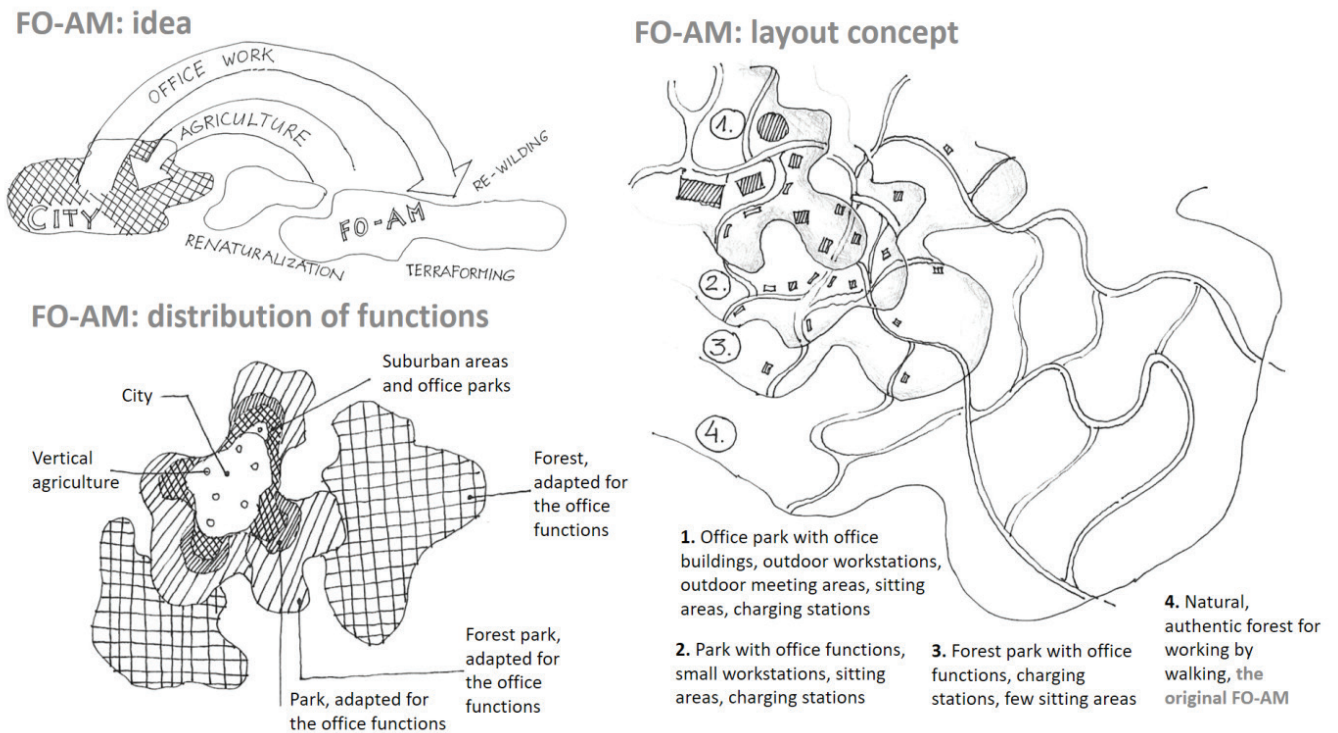


Fig.1. Visual presentation of FO-AM idea [Figure: Authors of the Article].

testament to human impacts on wilderness. If there is any hope of retaining a biodiverse planetary system, we must begin to learn how to coexist with and leave space for other species” [30]. In this context, mention should also be made of innovative activities, so-called re-wilding projects, such as the Knepp Castle Estate project near London, allowing coexistence of nature and people. Even the concept of terraforming can be considered in the context of nature and working environment integration. In 2015, the idea was suggested that the effects of climate change on our planet could lead to the creation of an intervention program aimed at returning the Earth to normal and more favorable climate parameters. For this purpose, a number of solutions have been proposed, such as solar radiation management, carbon dioxide sequestration using geoengineering techniques, or the development of climate-modifying genetically modified organisms [32], [33]. The FO-AM concept frames these strategies under the co-creational activity between humans, technology and natural environment by offering the new patterns of urban-wandering lifestyles.

II. FOREST OFFICE CONCEPT FO-AM

General idea. In his short story called “The Rescue Party”, which was first published in 1946, science fiction writer Arthur C. Clarke suggested possible timeline of humanity’s development in the future. According to him, since the human civilization had reached its cultural and technological peak, they left cities for villages and, most importantly, for the forests. The concept of FO-AM proposed in this research introduces the in-transition

patterns of this possible chance in the future, which could/would be required to occur due to the climate crisis, for the improvement of health and due to the technological capacities that allow for that change to happen. FO-AM concept suggests the following.

1. Office function can be resettled to the prepared forest areas outside the city. Such areas can be a combination of natural forests and purposefully re-wilded areas with specifically formed terrain. The entire FO-AM fabric consists of several interlinked zones with increasingly natural character: office park, park, forest park, natural forest, as it is demonstrated in Fig. 1.
2. Teams and individuals can perform office tasks (administrative, creative, coding and remote control of industrial procedures, etc.) mostly by walking in different zones of FO-AM: park, forest park and wild forest.
3. In the park zone (Fig. 1) there are workstations installed where it is possible to perform the tasks that require sitting, also these are used to charge electronic devices, etc. Nevertheless, we assume that due to the rise of ITC in the near future the protocol of performing any task will be based on direct neural control of equipment and tools that are located in various places across the Globe [34].
4. As it is depicted, the general structure of FO-AM (Fig. 1), the park is the smallest in area but dense with anthropogenic insertions, such as workstations or even small buildings if needed. The park is surrounded by the forest park, where nature is dominant compared to anthropogenic features and the area of which is much larger. Finally,



Fig. 2. Conceptual sketches of FO-AM spaces [Figure: Authors of the Article].

the original FO-AM, the nearly wild or wild forest, surrounds the previous structures (Figs. 1 and 2).

5. In relation to inversion of the city, the FO-AM is developed instead of existing farming fields, it can also encompass natural forests of various quality; simultaneously the farming is resettled inside the city by applying vertical farming methods. It is feasible that vertical agriculture in the near future will be able to provide full nutrition to city's entire population [35], [36].
6. To install the FO-AM, both approaches – re-wilding and terraforming – are used in order to achieve friendly micro-climates in the FO-AM, especially in cold, windy and rainy climates.
7. Although the distribution of residential function and accessibility of FO-AM is not the aim of this study, it is necessary to maintain that due to the inversion of the city concept itself the residential function will be located in the outskirts of FO-AM. The small urban settlements reminding of single farmsteads in terms of composition would be placed within the FO-AM as well, thus there would be no need to use motor vehicles to reach the work place at all.

Recently many tactics have been created and applied for bringing forest to offices, therefore we introduce an inverted form of

combining natural and anthropogenic realms. In this case FO-AM is organic derivation from historic experience that connects between wandering cultures and sedentary cultures.

Structure and equipment. There is different equipment developed in various countries for helping people to keep their contacts with nature in their daily lives. One of the most prominent examples, which can establish this connection, is the compact design of offices that can be easily located in nature without damaging the environment. Since people are spending a remarkable time in their daily lives in offices or at their workplaces, the increase in the usage of these types of equipment can benefit the quality of life of people.

The design of these settled working spaces can be in the shape of either a capsule or a cube, which can be mobile or stable depending on the concept. The layout of working spaces involves modular designs with the required space to work in an office environment with the furniture, furthermore, different modules can be added for business meetings as well. The material, which is used in the construction, can be wood or steel, however, the main focus should be on creating a sustainable design, which can also involve the usage of recycled materials. Therefore, electricity for the cube or the capsule can be provided either by solar power or wind power, depending on the place where it is situated.

On the other hand, the arboreal approach can be used for the nature offices as well, however, constructing these structures takes a longer period than using prefabricated elements. Ferdinand Ludwig is one of the pioneers of arboreal and *baubotanik* constructions, where he combined living structures with contemporary materials. By using pneumatic supporting elements, he managed to build structures, which can be easily implemented in the forest office ideas.

Vegetation. Regarding the specificity of forest vegetation and its suitability for work activities, many studies have been carried out, which examine the characteristics of forest that are important for human recreation and various types of recreational activities. However, it is much more difficult to find information on the suitability of the forest environment for any work activity other than industrial forestry.

Not all forests are suitable for human rest and active recreation. In this respect, dry pine forests and similar types of forests are highly valued. However, when it comes to the forest as a work space, it would be important to assess the different personal needs of people for the workplace (lighting, temperature, enclosure/openness, etc.). Decades ago, ecologist N. Dudley [37] described the concept of forest authenticity, which can be widely used to create a personalized forest office environment. Even a low-value forest (from a recreational point of view) can be integrated into FO-AM structure and used as a forest office because by creating the right conditions in the work capsule such an environment allows you to enjoy an exceptional view and feeling of blend into a truly natural, authentic environment. Such an effect could be achieved by maintaining the most natural conditions of forest-office vegetation as close as possible to local key habitats (vegetation of different ages and species composition, maintaining the structure of forest layers, moderate clearing, leaving parts of decaying trees to natural processes, etc.). Of course, the traditional recreational forest type is also suitable for office work activities; however, the FO-AM concept allows for a broader view of the use of natural forest vegetation characteristics.

III. DISCUSSION AND CONCLUSIONS

For the purpose of health of humans and environment it is clear that actions need to be taken instantly. Predominant examples to fight CO₂ emissions, such as planted green facades of buildings seem to even have negative overall effect on CO₂ emissions and environment in general. However, Ch. Alexander's et al. well know pattern called city-country fingers was based on the mankind's psychological need for direct interaction with natural or even wild environments [6]. Assuming that future technologies would allow to input data into any device much simpler, as well as the distribution of advanced technologies and shift of agricultural practices, we may foresee that humankind would not need necessarily to live densely in order to keep high productivity of goods. In fact, the concept of the good will alter from material good to the substantial or even spiritual good, thus the direct integration of anthropogenic realm and natural realm would become a self-valuable good [38]. In the frame of these forecasted

future technological and value changes we propose forest-office integration concept FO-AM: an ex-urban combination of natural forests and purposefully re-wilded areas with specifically formed terrain allowing to shift from office work by sitting to performing office tasks mainly by walking. The entire FO-AM fabric consists of several interlinked zones with gradually increasingly natural character: office park, park, forest park and natural forest.

To achieve this concept, an urban inversion effect is required, where typical functions such as administration, production and creation are moved outside the urban/up-built areas to the forest (both natural, re-wilded, and terraformed in order to achieve climate goals in a particular FO-AM unit). Typical functions of village or outskirts of city, such as agriculture or logistic centers or data centers, will be located in urban territories. Dwelling (residential function) would also be re-settled and merged into projected territories of FO-AM.

The FO-AM can be seen as a conscious evolutionary decision allowing to change the lifestyle and perception of the city. Even though it suggests radical change of currently predominant lifestyle patterns, it still seems to be an inherited practice deriving from the deep past of cultural and economic inception of the city/town phenomenon. Thus, it is to be a logic outcome of holistic historic experience used to solve complex problems of the future.

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