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Preface of the publisher

24. Journal für Facility Management: Science meets Practice

In the last weeks I had the honour to visit a lot of great workplaces like the Google Campus in Bayview as well as meeting up with a several top managers of well-established companies. The common topic was: How can we bring people back to office? Employees learned that there are several advantages while working from home: less time to commute, the capability to concentrate more when working on complex topics are only two examples. But they also stated that it is less easy to find the right work-life-balance: We recognise a higher burnout rate when only working from home.

This leads to another hot topic: The Environment, Social and Governance (ESG) regulation of the EU. Especially the Social aspect is asking for more responsibility regarding the people and their well-being. When implementing our ESG strategy we have to consider not only energy and resource savings. We must ensure the well-being of our employees, partners and customers. Balancing this trade-off is one of the most important tasks of facility and workplace management these days. This task is also a great value proposition for the core business, as it not only enables that people can do their work. If facility management is successful it empowers our employees, keeps their productivity high and their binding to the team and the company as a whole. This is the key factor for employer branding in these challenging times.

Therefore, this issue of the Journal für Facility Management provides you with hands-on insights of the safety issues regarding facility management and shows a best practise example on how hybrid working and coworking can be successfully implemented:

- *Facility Management and its potential new role in active infection control*
- *COWORK 15' - A Hybrid Work Research and a Coworking Pilot Concept*

The first paper sets focus on health of indoor workers. There, researchers experienced challenging times during Covid-19: aerosol particles were recognized as important infection carriers. While current indoor safety measures (e.g.: distancing, masks, filters) provided only limited protection, the first paper investigated a novel air-disinfection concept for populated facilities. The analysis depicts, that aerosolized bacterial microbes were surrogates for a viral contamination, particularly for the enveloped coronavirus. For the facility air purification tests, the researchers used aerosolized bacterial suspensions in a controlled office space. Following the results, the suggested air-disinfection technology added to the existing building ventilation

systems could be a valuable contribution for future infection prevention and control. Solutions like these may take facility management to a new level of providing environmental safety.

The second paper focuses on environmentally sustainable solutions. This paper aims to identify healthier lifestyles and sustainable amenities that protect residents from economic, social, and environmental impacts. The presented initiative focuses both on promoting hybrid work, developed as a relationship between organizational workspaces, residential spaces, and neighbourhood indoor and outdoor coworking spaces, and the (re)connection with the sustainable mobility solutions of the concept of '15-minute city'. The article gives an insight into the results of interviews with office workers in a centralized office and coworking space to show the workers mobility behaviour with alternative healthier and greener ways of working and mobility. That way the paper reports how employees report on differences in their well-being when working in a new work environment: an interior public coworking space and urban community gardens with dedicated outdoor co-working spaces. The paper gives a scientifically proved basis for decisions on locations and workplace design.

At this point, I want to thank all international researchers who sent us numerous abstracts and papers for the double-blind review. The decline rate was kept high with more than 50%. I also want to thank the members of the editorial and the scientific board for their terrific work. They supported me in reviewing first the abstracts and then the full papers and gave a lot of input to the authors. The high decline rate, the high reputed members of the editorial and the scientific board and the supporting universities ensure that the articles are not only highly scientifically qualified, but also that practitioners can put them into practice easily.

I also want to thank my team, especially Barbara Gurdet and Lisa Thrainer. Without their personal engagement the journal would not be available in this high quality.

I wish you all the best from Vienna, an enjoyable read, a lot of input for your research and/or for your daily work. I look forward to new striking research in the next IFM Journal and a refreshing exchange at the 16th IFM Congress from 23rd to 24th of November 2023.

Yours,
Alexander Redlein

Head of Editorial Board

To my family Barbara, Caroline Sidonie und Alexander David

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Science meets Practice I:
Operative Management

Facility Management and its potential new role in active infection control

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Abstract

Indoors, pathogen-carrying aerosol particles are recognized as important infection carriers like those in the current Corona pandemic. This infection route is often underestimated yet represents the infection route that has been least systematically addressed by counter measures to date. Current indoor safety measures (e.g.: distancing, masks, filters) provide only limited protection. Inhalation of hypochlorous acid (HOCl) containing aerosols was recently shown in several studies to be safe and effective in prevention and even in reduction of symptoms of already infected individuals (E. Rasmussen, Robins, and Williams 2021; Boecker et al. 2021b; 2021a; Wang L et al. 2007). We investigated a novel air-disinfection concept utilizing the potential of vaporized HOCl for populated facilities. Aerosolized bacterial microbes were used as surrogates for a viral contamination, particularly the enveloped coronavirus. For the facility air purification tests, we aerosolized bacterial suspensions into a controlled office space. The HOCl concentration was held at constant concentration with a software-controlled injection system (product: aerosolis® device; manufacturer: oji Europe GmbH, Nauen, Germany) and a special HOCl gas sensor unit (manufacturer: Draeger AG, Lübeck, Germany). We confirmed the disinfecting power of the used HOCl in suspensions and demonstrated the high efficacy of vaporized HOCl to deactivate airborne pathogens at safe and non-irritant levels (Test Laboratory: Microbiology Lab of Henkel, Düsseldorf, Ger-many). Incorporating this air-disinfection technology into building ventilation systems could be a valuable contribution for future infection prevention and control. It may take facility management to a new level of providing environmental safety.

Keywords: Hypochlorus acid, Indoor air cleaning, Infection control, Protective atmosphere

Introduction

Hypochlorous acid (HOCl) is a potent broad spectrum fast-acting antimicrobial agent with a favorable safety profile. It also is key actor of the body's innate immune response system offering the highest redox potential of all physiological intracellular occurring defense mechanisms. It was entered into the 'List N' of United States Environmental Protection Agency (EPA) for use in disinfection against the pandemic coronavirus (EPA n.d.; Ryan 2010).

All practical pathways of administering HOCl have been investigated and demonstrated a safe and effective way to enhance or complement the body's innate immune response. The methods span nasal and pharyngeal inhalation, topical applications (e.g.: wound care), and gastro-intestinal and even systemic intra-venous (i.v.) delivery. Increasing evidence is emerging of the beneficial effects of inhaling micro aerosolized hypochlorous acid (HOCl) as a routine intervention in the prevention and treatment of respiratory virus infections, including SARS CoV-2 (E. Rasmussen, Robins, and Williams 2021; Boecker et al. 2021b; 2021a; Wang L et al. 2007). The treatments reduce nasal and pharyngeal viral load and can minimize the progression and spread of the disease.

Nasal-spray treatments with aqueous HOCl solutions for fighting respiratory tract viruses have been explored in several pre-clinical trials (Yu et al. 2017; Burd 2020; 2019; Gutiérrez-García et al. 2022; Delgado-Enciso et al. 2021; E. Rasmussen, Robins, and Williams 2021; Giarratana et al. 2021). These HOCl nasal-spray formulations have shown bactericidal, fungicidal, and virucidal effects (Kim et al. 2008; Wu, Lin, and Jiang 2018; Giarratana et al. 2021; Yu et al. 2017; Sang Yu et al. n.d.; Cho et al. 2016; Bale et al. 2020; Yu MS, Park HW, Kwon HJ 2011; Gutiérrez-García et al. 2022; Stathis et al. 2021). Several of these antiseptics have demonstrated in vitro the ability to cut the viral load of SARS-CoV 2 in 15–30 seconds by 3–4 log10 levels. Several such products are already commercially available for prevention or early treatment of COVID 19 and have shown promising results (Burd 2020; product information: "Esteriflu® Nasal Antiseptic" n.d.). In this way HOCl has proven to serve as a potential solution for upper respiratory tract hygiene to assist intra-cellular defense mechanisms by its extra-cellular attack on pathogens (during the incubation phase of the infection when the virus is adsorbed at the mucosa and not yet inserted its RNA into intracellular space (Burd 2020).

It is important to differentiate the use of HOCl from an unqualified use of common place disinfectants which unfortunately has become popular as a response to the current pandemic. Basically, all of these common disinfectants are inappropriate and harmful for aerosolized use patterns in populated facilities (E. Rasmussen, Robins, and Williams 2021; Zheng, Filippelli,

and Salamova 2020; Dindarloo et al. 2020; Dewey et al. 2021). Toxicological evidence of serious adverse side-effects of repeated exposures, especially by inhalation of aero-sols, are emerging (Dewey et al. 2021).

Extensive research has been done previously with exposure to such disinfectant compounds, that is, quaternary ammonium salts (QAS), sodium hypochlorite, hydrogen peroxide, ozone, glutaraldehyde, and alcohols of various types. All of these were linked with an increased risk of either chronic obstructive pulmonary disease (COPD), asthma, and eye irritation on health workers and individuals when used regularly for internal or respiratory interventions (Rai, Ashok, and Akondi 2020; Casey et al. 2017; Dumas et al. 2019; Weinmann et al. 2019; Bracco et al. 2005). Also, the harmful and toxic effect of strong alkaline solutions of sodium hypochlorite (NaOCl) is often confused with the safe utilization of vaporized hypochlorous acid (HOCl) (Ashok, and Akondi 2020; Casey et al. 2017; Dumas et al. 2019; Weinmann et al. 2019).

Safety of any HOCl application is of course the most important concern. HOCl, when used as the sole component within approved limits, shows no negative side effects on living cells in topical, inhaling and even systemic applications. In animal studies with vaporized HOCl (way beyond necessary limits to be effective as a virucide) no detectable blood parameter change, nor any significant change of lung function was observed (Burd 2020). Also, in hu-man studies no observable changes in the endoscopic scores were detected after 8 weeks of regular exposure with HOCl via nasal irrigation (Yu et al. 2017). Thus, HOCl application could be considered safe to be used from a facility management perspective.

Methods and Materials

1.4. Suspension Tests

The biocidal effect of HOCl was demonstrated by a series of standard suspension deactivation tests, performed according to the methods of DIN EN 1656:2019 and CEN Technical committee 216: EN 1276, 13624, and 14476. This is important to prove efficacy of HOCl.

1.5. Room Air Purification

For room air purification tests, we aerosolized bacterial suspensions (with a protein load of 0.1 or 0.3 %) into lab chambers preloaded with a constant level of vaporized HOCl. The HOCl concentration was measured with special gas sensors (manufacturer: DRÄGER GmbH, Lübeck, Germany) and maintained at constant level with a software-controlled vaporization

device (product: aerosolis® (manufacturer: oji Europe GmbH, Nauen, Germany). Tests were carried out in two controlled measuring chambers (1m3 and 34 m3). The comparison and especially the experiments in the large chamber allow to draw conclusions regarding the efficacy of the application in regular rooms.

A newly developed two-step experimental procedure was used to determine the efficacy of vaporized biocide in the gas phase (no standard procedure is available yet):

1. *1. Determination of bacterial self-decay ('BLANCs')*
2. *2. Measurement of HOCl biocidal effectiveness*

Aerosolizing a bacterial suspension into a test chamber with an HOCl laden atmosphere results in a concentration/time profile determined by three factors: (1) number of injected bacteria, (2) self-decay rate of aerosolized bacteria, and (3) HOCl biocidal effect. Taking separate BLANC measurements (baseline) and HOCl laden measurements (cumulated bacterial self-decay and HOCl effect), allows to net out the biocidal HOCl effect.

1.6. Materials

Used test organisms for suspension tests: Enterococcus hirae DSM 3320 (corresponding to ATCC 10541), Pseudomonas aeruginosa DSM 939 (ATCC 15442), Staphylococcus aureus DSM 799 (ATCC 6538), Escherichia coli K12 DSM 11250 (NCTC 10538) and Candida albicans DSM 1386 (ATCC 10231). Vaccinia virus (strain Elstree) ATCC VR-1549 was used as test virus in combination withVero-B4-A 33 (DSM) indicator cells.

Test organisms used for room air purification: Staphylococcus aureus and Staphylococcus warnerii, Pseudomonas aeruginosa, and Escherichia coli K12 (strains all as above).

Table 1: Investigated microbes in aerosolization experiments

Bacterium	Type	Envelope
Pseudomonas aeruginosa	gram -	liquid membrane
Staphylococcus aureus	gram +	murein capsid
Staphylococcus warnerii	gram +	murein capsid
Escherichia coli	gram -	liquid membrane

A commercial preparation of Hypochlorous acid was used as biocidal agent: Biodyozon Clean Air (manufacturer. Biodyozon GmbH, Dreieich, Germany) with a 1,000 ppm HOCl stock solution, diluted with distilled water to 500 ppm.

Results

1.1. Suspension Tests

In standard suspension experiments we tested all relevant organisms with varying concentrations of our HOCl solution at low soil conditions (0.03% protein). Vaccinia virus as a model for enveloped viruses appeared to be even more sensitive. An overview of the obtained RF values is given in the following table:

Table 2: Biocidal effect of HOCl on various microbes [suspension tests]

	Pseudom. aeruginosa	Staph. aureus	E. hirae	E. coli	C. albicans	Staph. warnerii	Vaccinia virus
C [ppm]	Standard: EN 1276				EN 13624	Additional organism	EN 144476
800	**>5,33**	**>5,22**	**>5,16**	**>5,11**		nt	**4,75**
400	**>5,33**	**>5,22**	**>5,16**	**>5,11**	**>4,11**	nt	nt
300	**>5,46**	**>5,32**	**>5,54**	**>5,05**		nt	**4,75**
200	**>5,46**	**>5,32**	**>5,54**	**>5,05**	**>4,11**	**>5,50**	**4,50**
50	2,74	<0,95	1,52	4,53	<0,74	1,66	**4,00**
10	<1,09	<0,95	<1,17	<0,68		<0,68	0,50

Under the selected conditions (room temperature, low organic load and incubation time 30 sec), sufficient efficacy was found for all organisms (4 bacteria according to EN 1276, C. albicans according to EN 13624 as well as vaccinia virus according to EN 14476) at concentrations from 200 ppm HOCl. At a concentration of 50 ppm, however, efficacy against bacteria and yeasts was no longer sufficient. Against vaccinia virus, 50 ppm was still just sufficient, but 10 ppm no longer.

1.2. Room Air Purification Tests

The following graph shows the result of a typical HOCl induced biocidal measurement together with the corresponding BLANC test run. The dotted lines represent the exponential fits of the two curves for the period post the bacterial injection phase (t > 300 s).

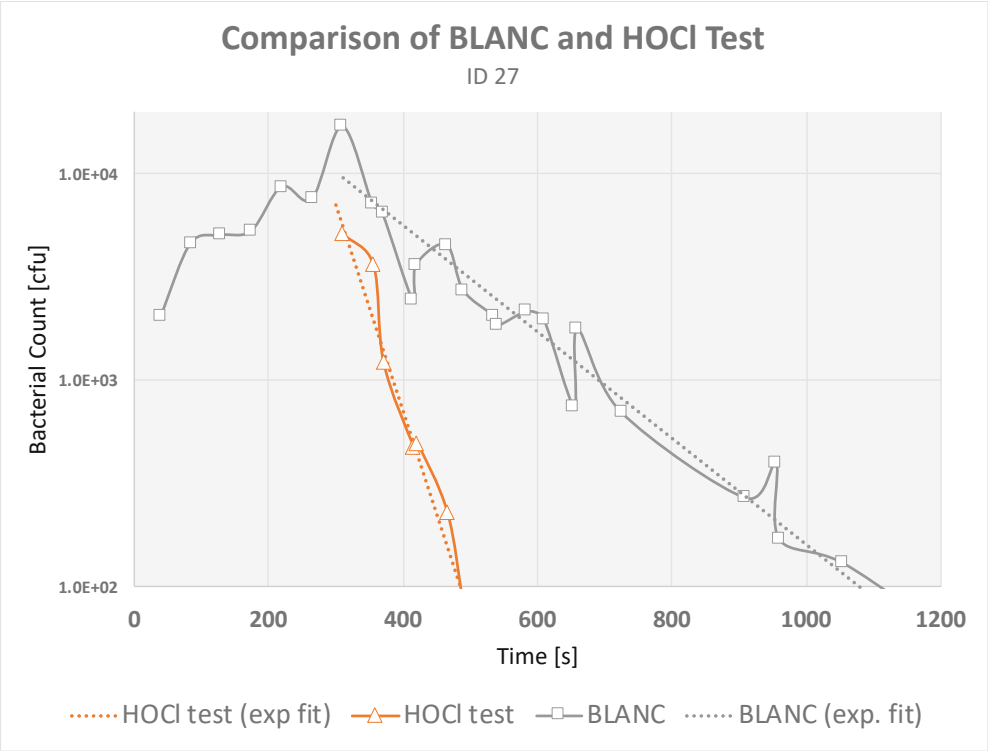

Fig. 1: BLANC and corresponding HOCl measurement

The determination of the net bacterial inactivation by HOCl (D_{B2}) is obtained under the premise that the bacterial self-deactivation (d_2), as determined through the BLANC tests (grey curve), and the HOCl caused effect are independent processes and behave multiplicatively to yield D_{comb}, which is measured in the HOCl tests (orange curve).

This provides for D_{B2}:

$$D_{B2} = 100 - \frac{100 - D_{Comb}}{100 - d_2}$$

The following graph shows the results for the disinfection rates D_{B2} for studied bacteria at different HOCl in-air concentrations.

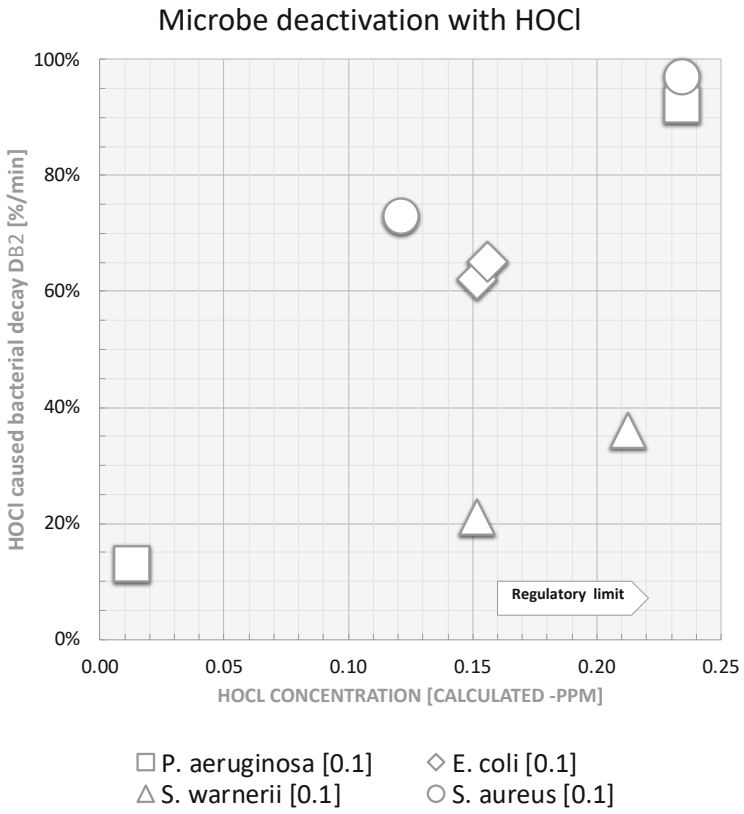

Fig. 2: Disinfection rates DB2 for various microbes at different HOCl inconcentrations

Fig. 2 shows the results for the disinfection rates D_{B2} for studied bacteria at different HOCl in-air concentrations. Within species the deactivation rate increases with the HOCl concentration. The absolute values are highest for the Gram-negative bacteria. The vertical dashed line marks the EU legal limit (0.21 ppm) for in-air free chlorine for long-term exposure in populated rooms. We demonstrated the dependency of the biocidal efficacy as function of the HOCl concentration (Fig. 3 - experiment with E. coli).

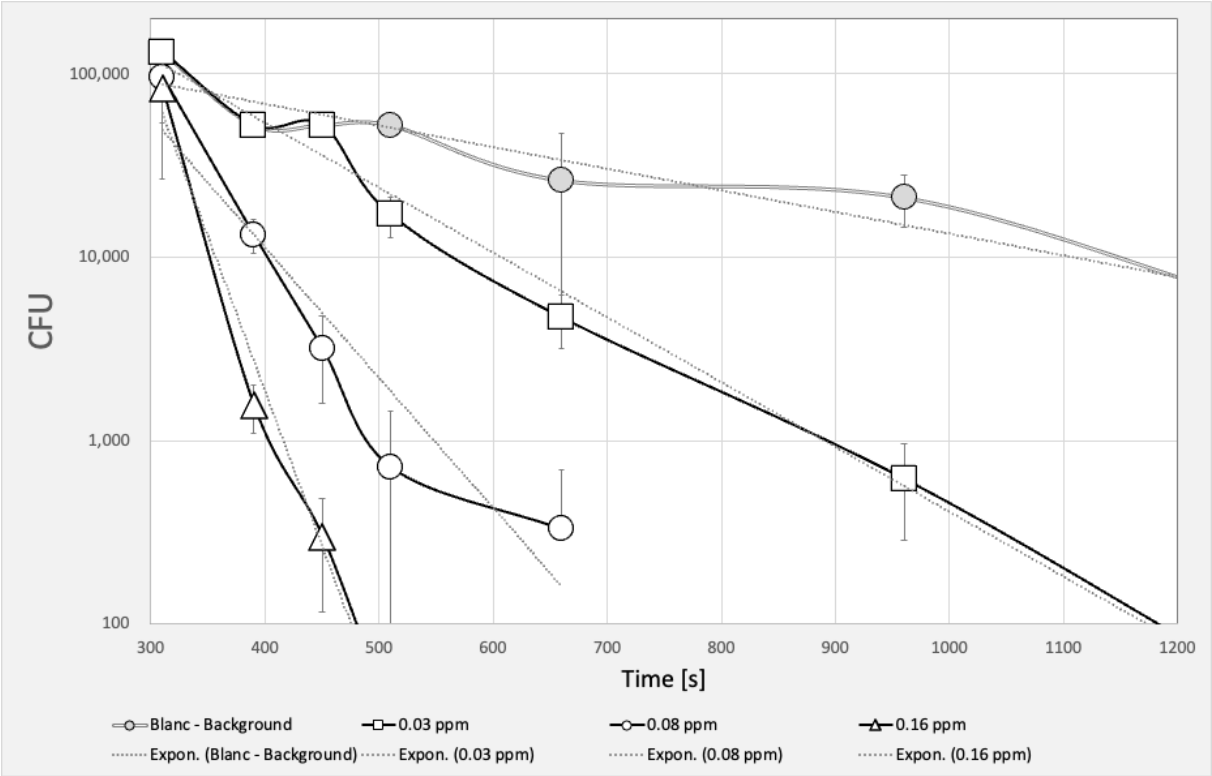

Fig. 3: Deactivation of aerosolized E. coli at different HOCl gas concentrations [95% confidence interval]

Plotting the measured disinfection rates against the respective HOCl concentration shows an almost linear relationship (Fig. 4).

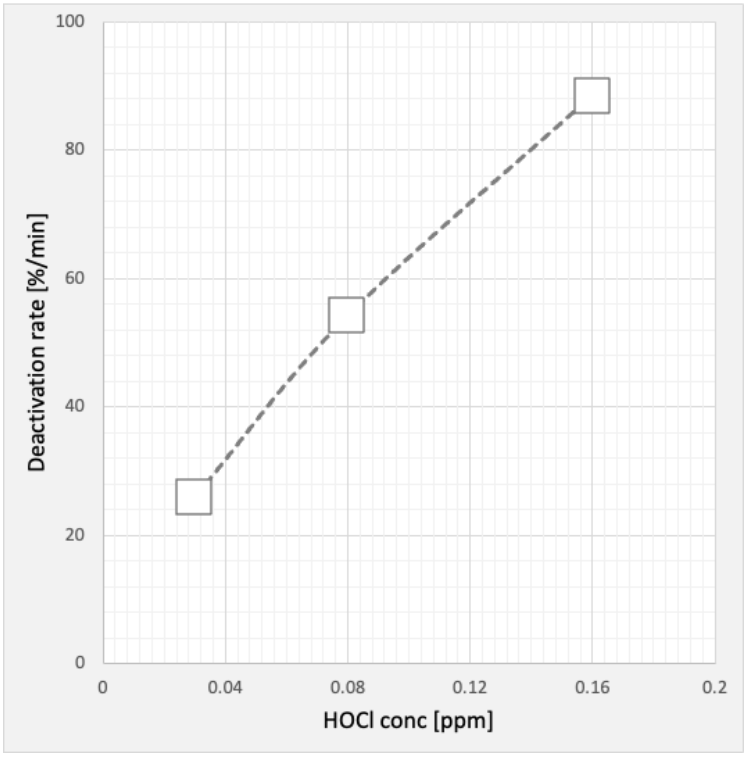

Fig. 4: Deactivation rates of E. coli in the gasphase as f(HOClconc.)

Transferring the results into a time domain of bacterial decay and HOCl exposure time, it becomes apparent how effective HOCl would reduce a bacterial or presumably viral load in a contaminated indoor atmosphere (Fig. 5).

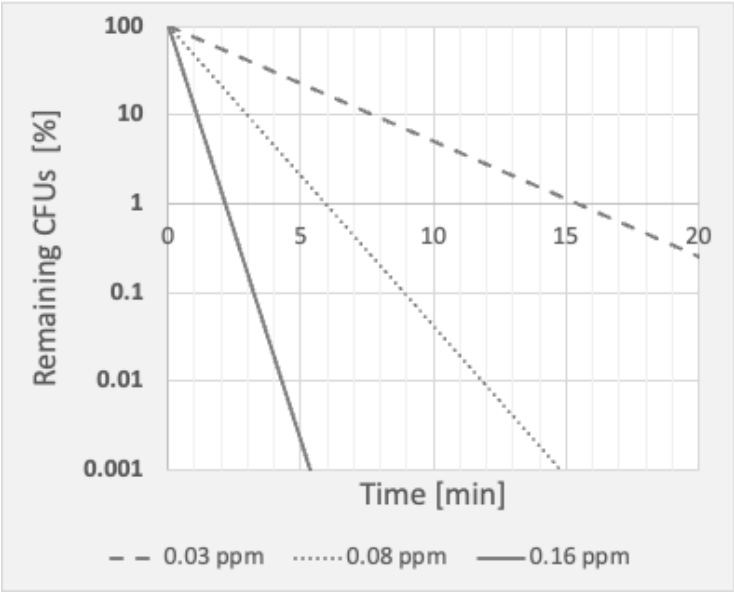

Fig. 5: Log Reduction versus exposure time for different HOCl gas concentrations (E. coli)

For example, the measured gram-negative E. coli bacteria at a concentration of 0.08 ppm (38% of the legal upper limit), the bacterial deactivation rate of 53% would result in a so-called log 4 reduction within 12 minutes. Unfortunately, real life situations are way more complex than a closed and fully controlled lab container. Most importantly, in real-life situations one must expect a more continuous virus contamination through a potential spreader. Therefore, the so-called log reduction – as used in filter classification and surface disinfection protocols for non-populated situations – can only provide a directional information. Thus the next steps need to include real life experiments and studies to confirm the efficacy under these conditions.

Discussion

The results of the suspension test support the biocidal activity of the used HOCl solution in this study. Bacteria and vaccinia virus show high susceptibilities to HOCl (vaccina even more sensitive). These results suggest (according to CEN TC 216) high sensitivity of all enveloped viruses (including SARS-CoV-2) to HOCl.

To measure the virucidal efficacy of an HOCl laden atmosphere is problematic since it would be requesting quantitative recovery of infectious virus particles from the air. Molecular biological detection of viral RNA via PCR methods would include inactivated virus par-ticles

as well. As a recourse to this principal issue, representative bacteria were used as surrogate organisms for infectious particles in the tests. Particularly, the vaccinia virus and structurally similar gram-negative bacteria (like E. coli) are considered a surrogate microbe for enveloped viruses (e.g.: SARS-CoV-2). The results indicate that enveloped viruses - given their chemical and structural similarity with Gram-negative bacteria - can be progressively deactivated with increasing HOCl concentration.

Vaporized HOCl can be used as an effective agent to deactivate pathogens mid-air. Aerosolized HOCl solutions (droplet sizes <10µm) vaporize within seconds resulting in an HOCl laden atmosphere (free floating molecules). Such 'active' atmosphere has the potential to interact with virus laden aerosol particles and any other airborne microbes (Spickett et al. 2000). The required concentration for an effective bacterial deactivation rate is well below legal limits, safe, and non-irritant (Nguyen et al. 2021; Rai, Ashok, and Akondi 2020; E. D. Rasmussen 2017).

Aerosolized infectious organisms are attacked by biocidal molecules either by droplet merge (aerosolinf./aerosolHOCl) or from the gas phase (aerosolinf/moleculeHOCl) (Thorn, Robinson, and Reynolds 2013; Masterman 1941; Edward and Lidwell 1943; Hakim et al. 2015), which suggest the transferability of our suspension and in-air test results: If the studied bacteria are deactivated, so will be aerosolized enveloped viruses.

Conclusion

Proactive facility management with novel ventilation concepts can become an important contributor for future infection prevention and control. The importance of our results is two-fold:

1. Infection prevention:

HOCl laden air may offer a safe, low-cost, and efficient way to secure a pathogen free facility atmosphere. In such equipped facilities the threat through infected virus spreading individuals would be contained effectively.

2. Disease progression:

HOCl enriched air has the potential to contain or even invert disease progress by attacking mucosa adsorbed viruses during the incubation phase. In this sense the facility atmosphere could offer a seamless disease containment function.

Today, any microbial insertion (through viral spreaders) will only be partly contained with incumbent safety measures. We confirmed our hypothesis of the high disinfecting power of HOCl-laden atmospheres. The method can be used in populated indoor environments because it is safe at the investigated concentration levels according to many peer-reviewed studies (Rai, Ashok, and Akondi 2020; Lapenna and Cuccurullo 1996; Mohapatra and Wexler 2009).

The potential of HOCl laden atmospheres to convert populated indoor areas into infection safe environments may allow to address other than just COVID related applications. Our here reported results and ongoing field test in large office buildings suggest that use of HOCl based room air decontamination counters the need for high air exchange rates for infection control. In doing so this approach can make a significant contribution to so much sought-after opportunities for energy savings. The HOCl air cleaning method is safe, cost effective, and easy to install and maintain.

Our early results suggest that HOCl based air-cleaning for populated rooms should be considered as a potential alternative or important enhancement to incumbent facility and personal disinfection protocols and should be further evaluated. This also includes further studies regarding the effect of HOCl on biological systems and the human body.

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Science meets Practice II:
Workplace Management

COWORK 15' - A Hybrid Work Research and a Coworking Pilot Concept

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Abstract:

Cowork15' is a component of largest research and development platform UrbanLink15' in partnership with UVT Digital & Green Living Lab. The goal of UrbanLink15's research is to identify healthier lifestyles and sustainable facilities that support residents from the economic, social, and environmental impact. Contributing to community wellbeing is the ultimate goal of the UVT Digital & Green Living Lab. The initiative focuses both on promoting hybrid work developed as a relationship between organizational workspaces, living spaces, and neighbourhood indoor plus outdoor coworking spaces, and the (re)connection with the sustainable mobility solutions of the concept of '15-minute city'. The article presents results of the 2022 Cowork 15'research based on interviews with office workers from the most important Timisoara's town business center and workers from a coworking space plus a focus group with people that work in a coworking space from Timisoara. The aim of Cowork15'research is to determine the workers mobility behaviour between home and workplace and motivations to change the current mobility behaviour with alternative healthier and greener ways of working and mobility. Also, the article presents a concept of an interior Public Coworking Space and an Urban Community Gardens with dedicated outdoor co-working spaces as pilot project.

Keywords: Hybrid Work, Workplace, Co-working, Alternative Mobility

1. Introduction

In view of the New European Bauhaus (NEB) initiative, launched in 2020 by European Commission President von der Leyen, the ecosystem active in Timisoara on the area of green jobs, ergonomic and sustainable development, joined efforts to contribute to an applied context for the European Green Deal, in an attractive, innovative and human-centred way.

The focus of Cowork 15' research is on the relationship between organizational workspaces, living spaces and local indoor plus outdoor co-working spaces that meet the need for professional relationships, outdoor activities, natural green-blue grids, and the need of community enhancement in the area of Timisoara city (Draghici 2022).

Head office has moved from statement of corporate power to social hub for cultural cohesion, learning and values sharing. Workplaces are more fluid, human resources operate rather like the circular economy of material resources. Rigid and complex hierarchies have been swept away, with leadership redefined as a more relational role. Key functions are to drive purpose, inspire employees and keep strategy agile. Management is flatter, with power devolved to teams and networks. This autonomy is underpinned with clear and transparent rules and expectations that link back directly to the organization’s purpose and vision (Capotescu 2019). Walk shops and standing meetings are well known as a way to promote wellbeing and fresh ideas. It has even been shown that ideas flow most freely in the countryside. Most organizations lack easy access to vast wilderness spaces and work teams are more widely distributed, so AR and VR could help.

In this context work from home and work from neighborhood co-working in the spirit of 15-minute city combined with periodically meetings and events at the client or employer office hub it is an effective sustainable and well-being way of work and live (Draghici et al. 2021). A 15-Minute City is a residential urban concept in which most daily necessities can be accomplished by either walking or cycling from residents' homes. The 15-minute city concept as a way to ensure that urban residents can fulfill six essential functions within a 15-minute walk or bike from their dwellings: living, working, commerce, healthcare, education and entertainment. The framework of this model has four components; density, proximity, diversity and digitalization (Moreno 2021).

Coworking is an arrangement in which workers of different companies share an office space, allowing cost savings and convenience through the use of common infrastructures, such as equipment, utilities, and receptionist and custodial services, and in some cases refreshments

and parcel acceptance services (2022 - https://en.wikipedia.org/). Major companies that provide coworking space and serviced offices include WeWork and IWG plc. In the same time, it is a large number of independent entrepreneurship or social entrepreneurship co-working spaces, or even public co-working spaces developments (Kraus 2022, Mohora 2020).

Along with the dedicated digital and green tools, health and wellbeing is being addressed by the UVT Digital & Green Living Lab with capabilities related to green jobs & ergonomics (Arts and Design, Organisational Psychology), psychotherapy and spiritual wellbeing (psychology, theology, arts, music and theatre), physiotherapy and telerehabilitation (physical therapy and sports), sports and healthy lifestyle, nutrition and dietetics, including functional foods and bioactive compounds (nutrition, biology, chemistry). All of these topics, along with embedding circular economy concepts in Urban Community Gardens, are tackled with the pilot Urban Community Gardens project that has the objective to be use also as neighbourhood outdoor co-working space.

Methodology of the COWORK 15' Research

The Cowork 15' research purpose is to evaluate the working and mobility behavior, but also the present and future of working ways of the office workers from Timisoara as base of a social entrepreneurial indoor and outdoor co-working concept. Cowork 15' survey is based on interviews with about 80 office workers from United Business Center – Iulius Town Timisoara participants at the event Iulius Outdoor Office Day from 21 of June 2022 and 20 office workers from FOR Workspace – FABER Co-working at the event International Outdoor Office Day at Faber (*https://meaningandfusion.work*). The unreviews will be made by volunteer students base on a questionnaire developed on the current article. The data analyze will be made by a scientific team from ErgoWork Society (*https://ergoworksociety.com/members/*). The methodology has base validation as model on the ErgoWork Society research Generations @Work (Capotescu et al. 2020, Mohora 2020).

2.1 Methodology of the hybrid and mobility behavior qualitative survey for workers from United Business Center – Iulius Town Timisoara

Main objective of Cowork15' survey from United Business Center – Iulius Town Timisoara is to determine the workers mobility behaviour between home and workplace and motivations to change the current mobility behaviour with alternative healthier and greener ways of working and mobility. The second objective is to find the present and future ways of working of the target respondents. It was applied a questionary to 60 respondents based on direct interview

made with operators. The segmentations of the answers will take in consideration two criteria, age of respondents – Figure 1 and the numbers of local employee in Timisoara that have the respondent's employer – Figure 2.

2.2. Methodology of the work and mobility behaviour qualitative survey plus focus group with workers from FOR Workspace Coworking Timisoara

Main objectives of Cowork15' survey and Focus Group from FOR Workspace Coworking Timisoara are to determine the workers mobility behaviour between home and workplace, the mobility motivations when the respondents chose FOR Workspace Coworking and the general motivations to choose to work from a coworking space. It was a questionary applied mainly online to the 12 respondents that are using the services of FOR Workspaces Co-working space. The segmentations of the answers will take in consideration two criteria, age of respondents (under 30 years old – 4 respondents, between 30 and 45 years old – 8 respondents) and the worker status (freelance - 5, associate in a small business - 5, employed in a SME 2).

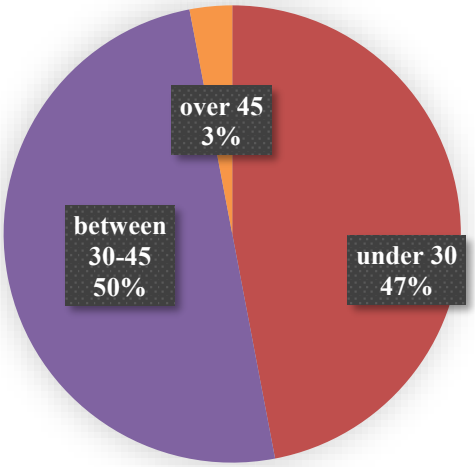

Fig. 1: Respondents age

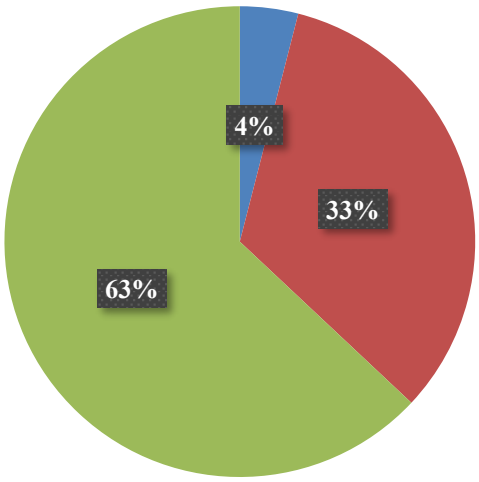

Fig. 2: Numbers of local employee

Results of the COWORK 15' Research

3.1 Results from survey for workers from United Business Center – Iulius Town Timisoara

The first question is an open one about the Way of Working adopted by employer of each respondent. It was used a multiple-choice question with one possible option and the results are presented in Table 1.

Tab. 1: Way of Working adopted by employer

#	Way of working (survey research results)	Percent (%)
1.	The company leaves the option to choose personally at any time between home teleworking and work at the company headquarters (hybrid work)	48%
2.	The company has so far opted for the predominant use of telework at home, with few exceptions for team	22%
3.	The company has opted for a full return to work in the company's own space	10%
4.	The company leaves the option to choose how to work from home or office, but once chosen we must respect the choice to be only at the company office or only in telework at home with occasional presence for team meetings at the company headquarters	8%
5.	The company leaves the option to choose personally anytime and whenever between work at the company's headquarters and any other location in Romania or outside Romania (hybrid - nomad work), without reimbursing expenses for work in other locations such as part of the rent - housing expenses or co-working subscription	5%
6.	The company leaves the option to choose personally anytime and whenever between work at the company's headquarters and any other location in Romania or outside Romania (hybrid - nomad work) and reimburses expenses for work in other locations such as part of the rent - housing expenses or co-working subscription	3,5%
7.	Other corporate politics	3,5%

As seen in Table 1, at the date of 21 June, majority of the branches of big multinationals companies with creativity work from the main Timisoara Business Centre are very flexible regarding of the office work of employees.

If the first topic is to determine the employer policy regarding of workplace, the second topic is design to determine the personal choices of the employee regarding of the favourites ways of working. It was used a multiple-choice question with one possible option and the percent of

choices are according with the Table 2 related with the employee age and Table 3 related with employer dimensions.

Tab. 2: Employee's favourite Way of Working by age

#	Way of working (survey research results)	Less 30 years old	Between 30 and 45	More than 45	General percent (%)
1.	To work 1-3 days a week at the company's headquarters and the rest to work from home	46,5%	30%	100%	40%
2.	Work from home and go to the company headquarters for team meetings no more than once a month	18%	30%	0	23,3%
3.	To work 1-2 days a week from the company's headquarters, to have a 1-2 days subscription to a neighbourhood co-working	21,5%	10%	0	15%
4.	To go to the company headquarters for team meetings at most once a month, to have a 1 – 5-day subscription to a neighbourhood co-working or another temporary residence location	11%	17%	0	13,3%
5.	To go to the company office every day	4%	13%	0	8,3%

Tab. 3: Employee's favourite Way of Working related with employer dimension

#	Way of working (survey research results)	Less 50 employees	Between 50 and 250	More than 250	General percent (%)
6.	To work 1-3 days a week at the company's headquarters and the rest to work from home	50%	50%	34%	40%
7.	Work from home and go to the company headquarters for team meetings no more than once a month	0	10%	32%	23,3%
8.	To work 1-2 days a week from the company's headquarters, to have a 1-2 days subscription to a neighbourhood co-working	0	25%	11%	15%

9.	To go to the company headquarters for team meetings at most once a month, to have a 1 – 5-day subscription to a neighbourhood co-working or another temporary residence location	0	15%	13%	13,3%
10.	To go to the company office every day	50%	0	10%	8,3%

Majority of the respondents prefer to have a flexible – hybrid way of working, but in the same time it is a percent by almost 10% that prefer to work daily from the employer own office space. Regrading of age differences it is a higher preference of the young people to be presence on the employer office but not every day. In the correlation with the employer dimension are also important differences. Respondents from bigger employers has a higher diversity of options and a highest percent of respondents prefer to be less connected with employer office.

Third question it is about the current mobility behaviour between home and workplace and time spent during of home and workplace with the results presented in the graphic from Figure 3.

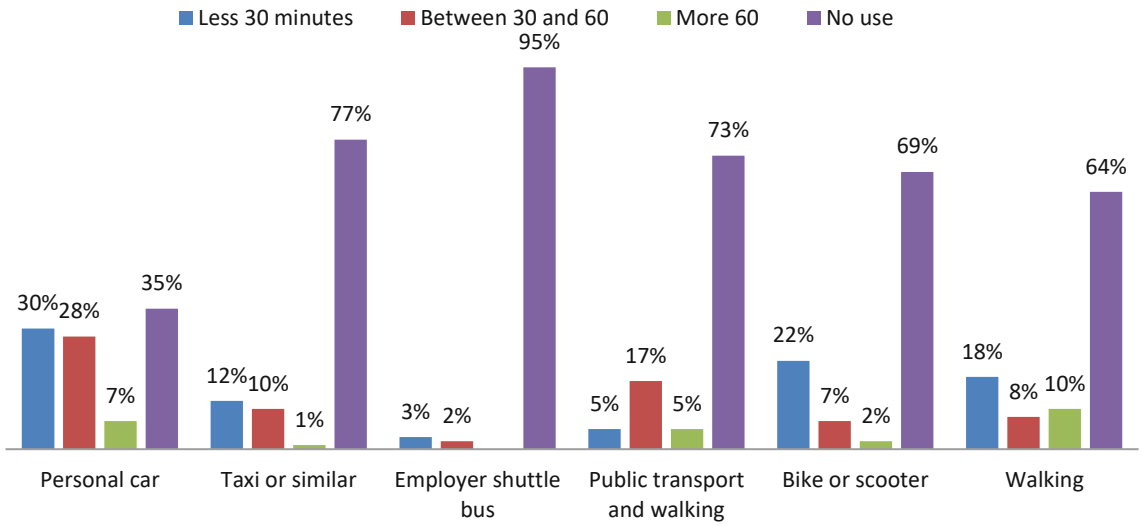

Fig. 3: COWORK 15' mobility behaviour and time spent between home and workplace

Personal car is not used by 35% of respondents. Public transport and alternative mobility as bikes or scooters are used by 27% - 31% from respondents.

Next question was about the motivation to reduce the personal carbon footprint following of changing the mobility behaviour, results from Table 4.

Tab: 4 Mobility motivations

No.	Motivations	Mobility type changing in:				
		Walking	Bike - scooter	Public transport and walking	Public transport and bike / scooter	Shuttle bus
1.	If I spend the same personal time as I do now	33%	31%	29%	5%	2%
2.	If my personal mobility time increases to 25%	19%	32%	21%	21%	4%
3.	If my personal mobility time increases between 25 and 50%	7%	32%	23%	16%	16%
4.	If my personal mobility time increases between 50 and 100%	9%	23%	26%	18%	25 %
5.	If my personal mobility time increases 2 to 4 times	5%	25%	28%	16%	26%
6.	If I had a natural route, green, shady, quiet and safe, and the mobility time would be at most 50% longer than the current one	37%	26%	19%	9%	9%
7.	If I had a natural route, green, shady, quiet and safe, and the mobility time would be at most 4 times longer than the current one	17,5%	39%	14%	17,5	12%

According with the survey results the respondents are motivated to walk if the time consuming for mobility between home and workplace it is as the current situation or about 25% longer, even if it is a blue – green, shady and safe way. If the time consuming it is longer, they prefer to use, bike, scooter, or a mix between public transport and walking or bike – scooter.

Fifth topic was about openness to choose a neighbourhood coworking subscription as workplace if the responded has a suitable offer. Majority of the respondents was open and interested about a potential opportunity to work from a co-working space placed at 15 minutes walk or bike from home, complete answer in the graph from Figure 4.

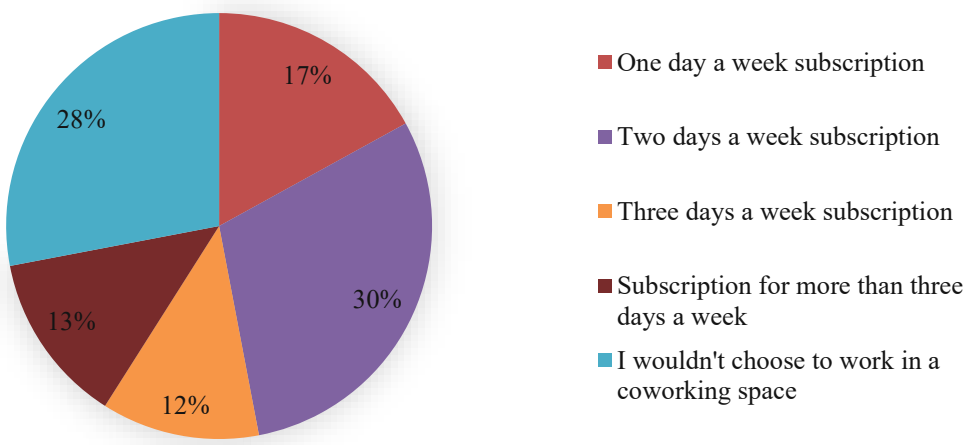

Fig. 4: Openness to choose a neighbourhood coworking subscription as workplace

The last topic was about openness to use potential outdoor facilities as following:

- *work in the outdoor space of coworking, 58% of respondents answered positive interested*
- *gardening in the outside working hours as an outdoor activity in a community urban garden run by a coworking, 53% answered positive interested*

3.2. Results from survey from workers from FOR Workspace Coworking Timisoara

First topic was about the general motivations to use a coworking space connected with the payment subscription. The answers were as following:

- *personal option to work in a coworking space and the subscription from my general income: 9 answers*
- *personal option to work in a coworking space but I have a budget allocated by the employer for such a subscription: 2 answers*
- *the employer's requirement to work from a designated workspace, other than housing: 1 answer.*

The topic about respondent's motivation of chose FOR Workspace has the number of answers (multi-choice question) according with Figure 5.

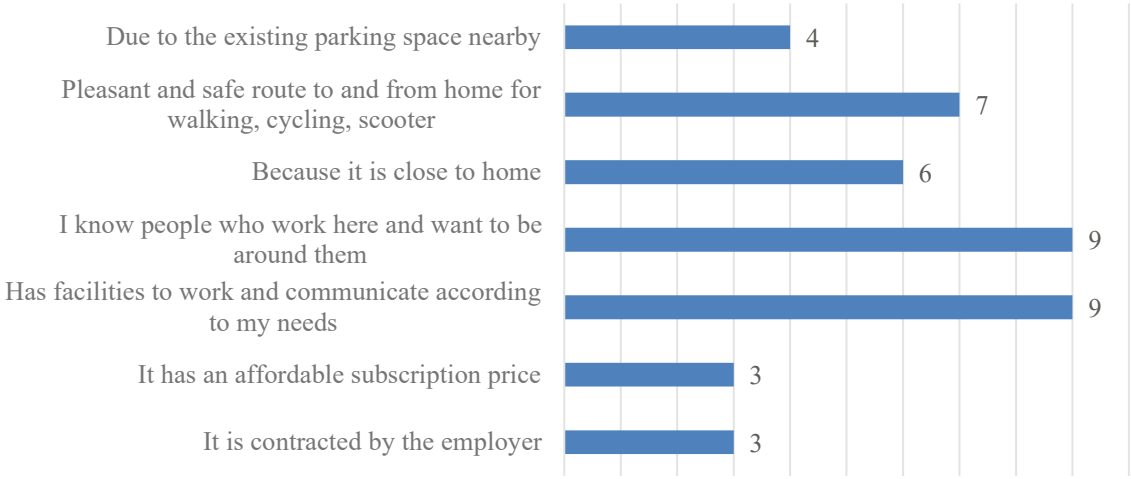

Fig. 5: Motivation to choose FOR Workspace

The question about the current mobility behaviour between home and workplace and time spent during of home and workplace has the results presented in the graphic from Figure 6.

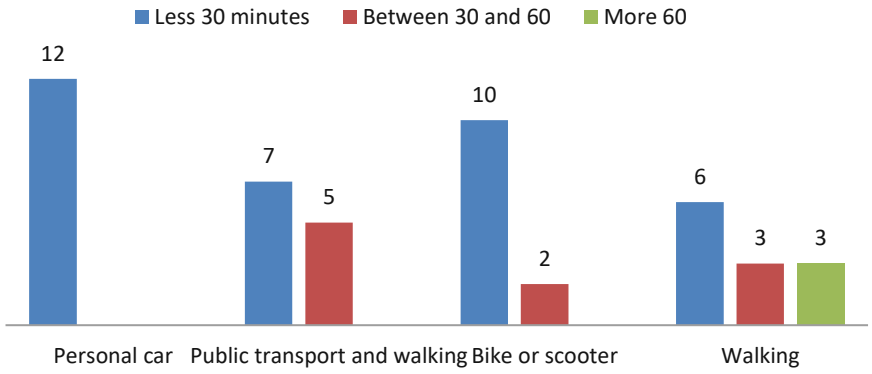

Fig. 6: COWORK 15' mobility behaviour and time spent between home and coworking space FOR

Regarding the motivation to reduce the personal carbon footprint following of changing the mobility behaviour, results from Table 5.

Table 5. Mobility motivations at FOR workers

No.	Motivations	Mobility type changing in:		
		Walking	Bike - scooter	Public transport and walking
1.	If I spend the same personal time as I do now	9	2	1
2.	If my personal mobility time increases to 25%	4	8	
3.	If my personal mobility time increases between 25 and 50%	5	6	1
4.	If my personal mobility time increases between 50 and 100%	2	8	2
5.	If my personal mobility time increases 2 to 4 times	2	6	4

6.	If I had a natural route, green, shady, quiet and safe, and the mobility time would be at most 50% longer than the current one	8	4	
7.	If I had a natural route, green, shady, quiet and safe, and the mobility time would be at most 4 times longer than the current one	3	7	2

The trend it is similar for the co-working users as for the employee from the United Business Canter. For a short mobility time increasing people prefer to walking and if the time increasing more, they prefer to use bike – scooter or a mix with public transport.

A half of the co-workers respondents that use the outdoor working facilities from Faber and the rest of six don't use them. Because the Faber stake holders are involved in the most important Timisoara urban community garden (Greadinescu GreenFeel), to test the interest about the concept it was used a question connected with this garden. Six respondents didn't knew the concept of urban community garden and never heard about the Gradinescu Greefeel. Seven respondents have heard about the garden but any one visited yet.

3.3 Results of the Focus Group and open question in survey about pleasant and dislike elements of co-working space

The open question and focus group revealed the known main advantages and disadvantages of co-working apace with accents from the pandemic times as following:

A. *Advantages*

- *The community feeling, diversity of the people but in the same time people quality*
- *Positive contribution to the productivity following of the increasing of the focus on work comparative with home work*
- *The positive contribution to the work – life balance as delimitation between the time and space of work and the rest of private life*
- *The quality of facilities from the co-working space as: internet and IT equipment, cleaning and other accommodation services, interior design quality, furniture quality and ergonomics, relaxing area and urban location*
- *A better feeling of free of hierarchy and authority control*
- *The opportunity to be close by other quality connected events organised by the co-working space*

B. *Disadvantages*

- *Difficulties regarding of the sensitive security data protection*

- *The general noise level background*
- *Difficulties of focus on a high attention task following of the general noise level*
- *Difficulties to organise and be focus on the individual online meetings*
- *Less psychological freedom to choose between work tasks and leisure activities in a certain moment*

Public coworking concept

Based on COWORK 15' research and bellow interior design premises we propose a model of a social entrepreneurial co-working in order to fill better the 15 minutes coworking grid from Timisoara as support for hybrid work and more.

The designers, architects and manufacturers challenge are to maximize the use of limited space, while generating a sense of safety and well-being and making room for more individual choices as we design, shape and build the dynamic home or workplace of tomorrow. DiY culture is a dynamic and ever-evolving process that can help meet our day-to-day needs, develop organizations, provide our own entertainment and education. In fact, the principle of DiY can be used to do anything. "The do-it-yourself movement is not just a hobby. It is often a pleasant and meaningful contribution to family life". Margaret Mead in 1957 (Gelber 1999).

One of the twentieth century's most influential pioneers Victor J. Papanek (1923–1998) and his key work, "Design for the Real World" about a socially and ecologically oriented approach to design beginning in the 1960s, remains the most widely read book about design ever published. In it, Papanek makes a plea for inclusion, social justice, and sustainability – themes of greater relevance for today's design than ever before (Papanek 2005).

In the COWORK15' Timisoara concept used the concept for a public space with the premises of DIY movement used international volunteers work and recycled objects for furnishing the space but also innovative products developed by students from West University Timisoara. The pilot concept takes in consideration the Timisoara co-working spatial grid, the 15 minute city rules and the idea of design for outdoor working spaces integrated in a urban community garden. The concept it is applied to a space converted from a thermal point part of the district heating grid of Timisoara (https://fitt.ro/voluntariat-in-centrele-de-tineret-din-timisoara).

The concept has a component of indoor coworking space, Figure 7 and a component of outdoor coworking space connected with an idea of community urban garden, Figure 8.

Fig. 7: COWORK 15' public indoor space concept


Fig. 8: COWORK 15' public outdoor space concept

Conclusions

The results of the COWORK 15' research show interest and potential development to integrate the coworking space as a tool for urban sustainable development in the frame of 15 minute city concept. The survey respondents were in generally aware about the personal carbon footprint and open to change the working and mobility behavior in order to improve the town sustainability and to enhance the neighborhood community using 15 minutes coworking spaces and urban community gardens.

COWORK 15' pilot concept show that can be found private and public resources to create a coworking grid at the level town in the frame of 15 minute city idea that can be used even by the youth and people that doesn't have financial resources for a co-working subscription developed as a private business.

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