

## Review Article

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# Open space office: A review of the literature and Hong Kong case studies

Lawrence W.C. Lai<sup>a,\*</sup>, K.W. Chau<sup>a,b</sup>, Stephen N.G. Davies<sup>b</sup> and Locinda M.L. Kwan<sup>b</sup>

<sup>a</sup>*Ronald Coase Centre for Property Rights Research, University of Hong Kong, Hong Kong*

<sup>b</sup>*Department of Real Estate and Construction, University of Hong Kong, Hong Kong*

Received 16 April 2019

Accepted 31 March 2020

### Abstract.

**BACKGROUND:** Open plan or open space office has become increasingly popular but those who promote the concept seldom refer to health studies or workers' perceptions of a change in office layout towards an open space arrangement.

**OBJECTIVE:** To review the literature on open plan or open space office layouts in terms of facilities management (FM) with users' perceptions in mind and to obtain opinions of users of open space offices for a better appreciation of the FM issues.

**METHODS:** A literature search of research papers from 2007 in journals using the keywords "open plan office" and "open space office" plus "health", first in the titles then in the text, was carried out. Thirty-two of those papers, accessible by the authors' institutions, were consulted together with 5 other works in the Harvard Business Review. The review consulted but excluded papers and reports published or sponsored by commercial firms that were in favour of open space layouts. Case studies were conducted by face to face meetings in confidence with workers in the middle managements of twelve Hong Kong organisations known as friends to two of the authors. Problems as seen by staff are reported and discussed.

**RESULTS:** The literature review reveals that apart from writing that promotes the use of an open plan office layout, a host of scientific works point to the problems of perceived dissatisfaction with such a layout, the nature of the dissatisfaction tending to depend on the actual design. Most workers interviewed disliked the new style open plan layouts, which points to the necessity of consulting workers when such changes are contemplated, as well as monitoring the results of the change once it is in place whether against workers' wishes or with their support. There is a need for a number of facility arrangements in making a change to open plan that ensures that worker needs for proper lighting, privacy, and indoor health will be met.

**CONCLUSIONS:** If the aim of a change to an open plan arrangement is to promote collegial communications in office, the study sheds light on the extent to which such arrangements may not in practice be suitable for achieving the aim. It follows that further, more specifically sociological studies of workers' job satisfaction and emotional health in open plan office settings would be worth doing.

Keywords: Office layout, facilities, lighting, privacy, indoor health

## 1. Introduction

The open plan or open space layout for office activities has become increasingly common as the standard way to organise office space. The trend is that conventionally enclosed cell rooms – the

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\*Address for correspondence: Professor Lawrence W.C. Lai, B.Soc.Sc.(Econ), M.T.C.P., M.Soc.Sc. (Econ), LL.B, PhD, Ronald Coase Center for Property Rights Research and Department of Real Estate and Construction, University of Hong Kong, Hong Kong. E-mail: wclai@hku.hk.

very meaning of ‘office’ in common parlance – are reserved for upper management.

Gone are the days of a clear hierarchical order of rooms of different sizes and fittings for managers and supervisors at different ranks: everyone, other than a few top managers, has no personal room but shares a common area.

Many offices now do not even provide staff with any fixed work station. Staff on arrival at work each day select places on a first-come, first-served basis, as in a university lecture room. This is sometimes called ‘hot desking’ or, more barbarously, “non-reservation-based hoteling” [1]. In terms of property rights economics propounded by Alchian and Demsetz [2], this means that for each individual worker using the open space, the office has become more a communal than an exclusive area.

This drive towards communal workspaces, has been defended by two main arguments. The first rests on basic business economics: rent economisation by reducing overall space, which some research has shown may be as great as a 30% [3]. The second is a combined human resources/worker productivity argument: namely that open plan offices promote easier communications and/or a more egalitarian mode of operation [4]. The first manifestly places company profits ahead of worker welfare. The second is hardly a defensible argument given that pay and authority are not shared equally. Either way, the shift towards open plan, now over two generations old, has attracted a lot of criticism based on its effects on staff morale, collegiality, and even health.

Facility managers often have no say in deciding office layouts, which are often imposed by company directors, who come and go based on reasons that are not typically science-related. Unlike the old days, these directors may not be major shareholders of their companies, but rather appointees of international funds, and usually desire little direct contact with “frontline” staff in the open plan regimes they mandate.

Given the implicit lack of control over the fundamental principle in terms of which office space is arranged, it is therefore critical, in the case of the decision for open plan arrangements, that facility managers are sufficiently competent to advise on the optimum arrangements for avoiding, or least minimizing potentially adverse effects.

This paper will offer some ideas for such advice based on a critical review of the literature on open space offices and twelve case studies based on personal knowledge of the offices involved.

## 2. The landscape of research on open space office layouts: A literature review

A literature search of research papers by Google scholar from 2007 to January 2020 in journals using the keywords “open plan office” and “open space office” plus “health”, was carried out first in the titles and then in the text. Thirty-seven papers were accessible by the authors’ institutions and were consulted, together with five relevant works in the Harvard Business Review. The review also consulted but excluded from its results papers and reports published or sponsored by commercial firms that favoured open space layouts, or that deal only with “high performance” open plan layouts. The literature review shows that apart from writing that promotes the use of open plan office layouts, a host of scientific works point to the perceived dissatisfaction with this layout and the sorts of workplace problems that ensue depending on the actual design used. It should be noted that this is not a scientific inquiry into the credibility of each study. It is, rather, a mapping of the research landscape in the Lockean sense of “an under-labourer . . . clearing the ground a little, and removing some of the rubbish that lies in the way to knowledge.” [5] Given the shortcomings of this survey due to resource limitations, the findings are sufficient to lead a reasonable person to have doubts as to the credibility and viability of open plan offices, as promoted by some commercial firms and their sponsored researchers. Put another way, whilst at best only indicative, this research serves to illuminate the extent to which the fundamental motivation for choosing open plan is usually economic.

There are, of course, supporters of open plan layouts. Ono et al. [6] pointed out that some social psychology research seems to have revealed that an open space layout encouraged communication between employees and *improved* their work satisfaction. However they added the rider that any such findings depended on the number of participants and type of communication that was being assessed.

Some studies are more objective. Crucially, they are careful to distinguish between the traditional *cellular office* with walls on all four sides and a lockable door, and the four basic forms of open plan layout. These latter are: *complete open plan* with no partitioning of any sort sometimes known as a ‘bullpen’ layout; *team enclosures* – each group has a completely open plan work space but is partitioned off from other teams – this is also referred to as a multi-person office; *half-partitions* – each space is divided

from the next by a low partition that can be seen over from a standing or slightly stooped position; *full cubicles* where each space has a standing height partition around three sides – these are also misleadingly known both as bullpen and as cellular offices. To this must be added a number of variations as new arrangements structured on the basic open plan idea enter the market such as *flex* offices – a mix of shared areas and dedicated work places – and *combi* offices – a mix of cellular or cubicle office spaces with open plan spaces. Shared areas and open plan common spaces are often designed to act as ‘break-out spaces’ and ‘chill-out areas’. It should be noted that this plethora of different arrangements and the extremely untidy nomenclature increases the difficulty of securely based quantitative evaluation.

Lee [7] examined various forms of open plan offices in the U.S. and found that the “bullpen type, open-plan office without partitions” gave significantly higher satisfaction when it came to noise level and higher performance perceived by acoustic quality than both high and low cubicles. Lee and Guerin [8] found that indoor air and lighting qualities were invariant to enclosed private, enclosed shared, and bullpen office types. Shahzad et al. [9] found that Norwegian workers in cellular offices performed better than their British counterparts in open plan offices in terms of user satisfaction and comfort under individual thermal control. However, Norwegian office energy consumption was much higher.

Generally, however, scientific and management research lends greater support to critics of open space layouts in a great variety of cultural settings. As early as the late 1970s, Oldham and Brass [10] found that employee satisfaction and internal motivation dropped significantly after they were switched to open offices. Pejtersen et al. [11–13] and Allermann et al. [14] found that the occupants of Danish open-plan offices were more likely to perceive thermal discomfort, poor air quality, and noise. Also, they complained more about central nervous system and mucus membrane symptoms compared to occupants in multi-person and cellular offices. Danielsson and Bodin [15] discovered that Swedish employees had the lowest health status if they worked in medium-sized and small open plan offices, but had the best health in cell and flex offices. They also found that the lowest job satisfaction went to those in combi offices, followed by medium-sized open plan offices. Haapakangas et al. [16] found that Finnish workers in open layout offices experienced more stress, particularly overstrain and concentration

difficulties, and attributed these symptoms to office noise. Lindholm [17] considered that time wasted with interruptions was an inherent feature of open space layouts. Kaarlela-Tuomaala et al. [18] found that Finnish office workers, upon relocating from closed to open plan offices, had increased distraction, reduced privacy, increased concentration difficulties and increased use of coping strategies, as well as lower self-rated performance due to noise.

The above results were corroborated by those of Bergström et al. [19], who found that Swedish employees’ perceptions of health, work environment, and performance declined during a 12-month period following a switch from individual to open-plan offices. Kim and de Dear [20] concluded from a study using the Center for the Built Environment at the University of California, Berkeley that “enclosed private offices clearly outperformed open-plan layouts in most aspects of indoor environmental quality, particularly in acoustics, privacy and the proxemics issues.” Lee et al. [21] found that for both Chinese and Korean office workers, job satisfaction and satisfaction with the environment were negatively correlated with the lack of speech privacy in open space offices.

On the other hand, Meijer et al. [22] concluded that an open plan layout, as an “innovative design,” had no or a limited *long term* effect on worker performance, but admitted that there were *short term negative perceived effects* on productivity and health. In a Finnish study, Rosila and Rothe [23] found that the matter was generation-dependent and concluded that younger workers tended to prefer open layouts, while accepting some of their limitations as trade-offs. Seddigh [24] argued in his thesis that the performance of workers in cell offices was not higher than those in open plan situations, but in open-plan offices, smaller ones were associated with fewer problems. A statistical survey by Danielsson [25] of office employees working in one of the seven identified office types in contemporary office design: (1) cell-offices; (2) shared-room offices; (3) small, (4) medium-sized and (5) large open-plan offices; (6) flex-offices and (7) combi-offices show that the shared-room office, traditional open plan offices and flex-offices stand out negatively in terms of workers’ perceived welfare. The recent study by Bernstein and Turban [26] showed what kind communication was promoted and inhibited by open plan layouts. They found that design “appeared to trigger a natural human response to socially withdraw from office-mates and interact instead over email and IM (instant messaging).” Morrison and Smollan [27] concluded

that there are *compelling findings* that open-plan office environments are associated with declines in employee wellbeing. However outcomes depended on whether ergonomic principles (see [28]) had been followed and staff had been consulted to assess both their psychosocial needs and job requirements.

What, then, are the solutions to these problems in open plan offices, granted that they are here to stay and are promoted rigorously by property consultants? Roper and Juneja [29] held that providing suitable facilities, including appropriate and adaptable workspaces, is needed to meet the dual needs of collaboration and concentration on complex tasks to maximise worker contribution and value. Maher and von Hippel [30] confirmed the theory that satisfaction and worker performance in open layouts would be reduced for employees with poor “stimulus screening” or poor inhibitory ability. One such screening should be noise-masking, as acoustics is certainly a major area of concern as held by Virjonen et al. [31] and Calisi and Stout [32]. Haapakangas et al. [33] tested 7 noise sources that helped alleviated distractions in open plan offices and found spring water to be the best speech masker and it has helped Finnish workers cope with working in open plan offices. Another Finnish study by Hongisto et al. [34] found that some significant improvements were noticed in environmental satisfaction due to physical changes provided by refurbishment. Keränen and Hongisto [35] investigated the variables that influenced distractions caused by irrelevant speech and a lack of speech privacy, which are typical problems in open space environments, before calibrating a predictive model for office design. Shafaghat et al. [36] considered 27 past studies and produced a list of 12 desirable and 15 undesirable features for shaping office designs to mitigate the problems of open plan offices. Another area of concern is air quality, as Wolkoff [37] showed.

### 3. Twelve case studies

Case studies were conducted by two of the authors individually by informal discussion with workers in the middle managements of twelve Hong Kong organisations from June 2016 to June 2018. These twelve case studies covered typical types of organisations in Hong Kong. The resource limits of the authors led to the choice of these twelve using friends, who consented to the unstructured interviews subject to hiding their names and organizations. They

are nonetheless probably the first of their kind done in Hong Kong. The information was collected by unstructured interviews in confidence to protect the providers. In conformity with Hong Kong’s rigorous privacy legislation, all information provided was protected. Table 1 summarises the nature of the organisations under study and the changes in their office layouts. None was a university department, or consultant promoting open plan layouts. In only two cases (Nos. 6 and 7) was the affected staff member or her/his colleagues consulted about their existing office layouts prior to the implementation of the changes.

#### 3.1. Case one: From closed to open spaces with low cubicles

The original office was conventionally laid out with managers occupying traditional cellular offices and more junior staff sitting in open plan offices with partitions. At regular intervals during the morning and afternoons, individual managers emerged from their rooms and gathered in the common areas to chat and exchange professional views and other information. After relocation to another self-owned “Grade A” office block in a lower bid-rent district, this arrangement disappeared. (The Hong Kong Government Rating and Valuation Department classifies offices into three Grades: A, B, and C.) In the new premises, only senior managers continued to have cellular offices, while the rest sat in an open plan office with low cubicles. The change was definitely not due to the desire to cut rental cost, as the company was making money and the layout was designed by a famous consultant, the new premises charged a lower bid rent, and staff numbers increased. A comment by a senior manager, who was promoted from within the company summarised the change: the collegial atmosphere had disappeared with the new layout.

#### 3.2. Case two: From low cubicles to completely open spaces

The facility manager in this case had to change a large office, which received its natural lighting from a huge curtain wall of glass, from a partially to completely open layout for his facilities office, which handled accounting, customer services, and engineering services. At the same time, considerations were made to obtain green certification for the office along the lines of aquaponics, energy savings, and noise reduction. Yet, constrained by his budget,

Table 1  
The general nature of the organisations studied and office layout/design

Case	Nature of firm	Office layout/design
1	Local developer	From closed to open spaces with low cubicles for middle professional staff
2.	Facilities office of a technological institution	From low cubicles to completely open spaces
3.	International insurance company	New office as open space from the beginning
4.	International insurance company	Complete open plan layout in the new office
5.	International insurance company	Complete open plan proposed
6.	An international IT company	From conventional office to a flexible-workstation arrangement
7.	A PRC company in port business	Additions of workstations with minimal partitions
8.	A local bank	Open plan office with medium height partitions
9.	A statutory organisation	Open plan office with tall partitions
10.	A statutory body	A single work team taking up a single office with cubicles with glass partitions
11.	A government office	Open plan office layout unlikely to change
12	A government office	Two teams sharing a team enclosure

the manager could not implement any staff suggestions while the sun screens, cubicles, and partitions were removed as part of the conversion to an open plan. Staff grumbled as noise interference increased and the glare of the sun became unbearable. To cope, some staff opened umbrellas to serve as light screens and created a surrealist atmosphere. Staff turnover increased, given the strong market demand for facility management practitioners.

### 3.3. *Case three: New office as open space from the beginning*

The office of this Pacific Rim firm was designed from the start as an open plan office and top management was very proud of it. It was not the most trendy “floating classroom” type of seating arrangement and staff did not need to compete for the best seats on a first-come, first-served basis. What was observed was that staff made efforts to “privatise” their allotted work stations by using personal items to form barriers so that sometimes the person who gave the authors this information had the urge to tidy up the premises. There were also a few colleagues who talked loudly and disturbed others’ work. The correspondent personally thought that an open plan was not good, but that it was company policy.

### 3.4. *Case four: Complete open plan layout in the new office*

The European insurance company had a flat management structure and this was reflected in its office layout. All staff, including the CEO, worked in a bullpen office without any cellular or partitioned spaces. This open design was adopted with the organization’s local relocation and was a corporate policy for offices in all regions.

Before relocation, senior management worked in cell rooms and general staff worked in cubicles with taller partitions. The company in its old location had assigned some chill out areas for casual chats and also phone pools for making important calls in the new office.

The new design was not welcomed by staff because the open design was noisier and this affected their attention to their work. Besides, their job nature did not really require close communication and the common area for casual chats was not actually utilized.

### 3.5. *Case five: Open plan proposed as complete open space*

An international insurance company was consulting staff about three options: status quo (conventional layout with offices for managers and confidential areas); a complete open plan design with no designated work station; and a less radical layout. The open option would provide overnight lockers for company’s computers for staff. Staff were generally resentful of the second option as they saw it as a reckless decision as the system was not paperless and there would be risks of mishandling sensitive information and difficulties in locating colleagues in the company as everyone would be moving around. Staff believed that the consultation was just a management show.

### 3.6. *Case six: From conventional office to a flexible-workstation arrangement*

An international IT company, which has a flat structure, followed the trend to open plan offices after its relocation. Only staff of the top management were allocated cellular offices. Middle management staff, who were used to working in cellular offices, were

no longer assigned them. At the same time, general staff were not assigned with fixed workstations and the number of workstations was less than the numbers of staff. That meant that staff coming late would not have a workstation and would need to work off-site or at home. They also needed to clear their workstations before leaving the office. Although the nature of their jobs involved much off-site duty, the new arrangement did not help staff to feel any sense of belonging. The middle management also did not appreciate this arrangement because they were not used to working in an open plan office, which was noisier and did not provide them with privacy. The facilities manager consulted on design before the relocation but the adoption of the flexible workstations and open plan office was a corporate policy, which was the same across countries so could not be changed. The adoption of the open plan office had helped the company to save costs because they could house the same number of staff in a much smaller office.

### *3.7. Case seven: Additions of workstations with minimal partitions*

The office of a Mainland Chinese company also adopted an open plan office with general staff working in cubicles but senior management working in cellular offices. The partitions were of medium height but each staff member was assigned sufficient space to work. The staff were fine with the design because it provided them with adequate privacy.

Although the open office was noisy, it allowed them to have prompt verbal and non-verbal communication, which was required in the office due to its work nature. The arrangement of senior management taking up cellular offices also suited the hierarchical management culture.

However, the company was also renovating the office. Some workstations in the newly-fitted office would no longer be separated by partitions. The staff working there, who were used to working in partitioned-cubicles, were unhappy with the new design as they would find themselves having very little privacy. The new design allowed the company to increase its manpower within a limited office space and this obviously would help cutting costs.

### *3.8. Case eight: A bullpen office with medium height partitions*

The local bank moved to the current office 10 years ago and all offices, including those in other

countries, had the same design. Only department heads had cellular offices while all the other staff worked in cubicles with medium height partitions. All cubicles were the same size regardless of rank or position. Members of staff in the same team were grouped to be seated close to each other. This allowed them to have easy communication.

Staff generally accepted this design because they needed to work closely, and face-to-face communication was essential. However, it was felt that there was noise nuisance in this layout and taller partitions were desired as this would allow them to talk without mutual interference. It is generally thought that the adoption of the open layout had helped cut costs for the company.

### *3.9. Case nine: A bullpen office with tall partitions*

The public organization is hierarchical and inflexible to change. The head office has a bullpen office design with only very few senior managers working in cellular offices. All staff worked in cubicles of similar size with relatively tall partitions. Due to the job nature, team members needed to work closely and frequently communicate. However, staff found that the tall partitions did not allow them to have prompt communications and staff tended to work independently, which was less than ideal for their job. Middle management staff also did not have any space identity as most staff worked in cubicles with the same size and types of partitions. There had been discussion about changing the office layout to a more open design because the senior management would like to have a greater transparency and better management of the office. There was no definite plan for the time being.

### *3.10. Case ten: A single work team taking up a single office with cubicles with glass partitions*

The public organization had a big hierarchical structure to oversee its services across Hong Kong, with a large headquarters to house a huge staff. In the headquarters, each team takes up an individual office space with the team heads taking up cellular offices in that space. General staff, who might need to work off-site, work in cubicles with relatively tall but transparent partitions. Since only one team took up a single office, members of staff could discuss work matters in an open manner and prompt communications were

feasible. The tall partitions helped lower noise disturbances and yet provided some visual transparency as they were made of glass. Team heads found it easier to communicate with team members and staff were generally satisfied with the design.

### 3.11. *Case eleven: A bullpen office in a government department*

Due to the hierarchical structure and sensitive nature of the government office, the staff works in cubicles with relatively tall partitions with senior staff working in cellular offices. Because the office handles certain confidential and sensitive information, the layout and office design provide staff with a quiet environment with a certain degree of privacy, which the staff welcome. This design does not allow them to have prompt communications but the staff still could communicate face-to-face when necessary. Since it is a government department, there are standards and guidelines in space allocation that cannot be changed easily. Though a government department has generally more space per worker, there are also far more hard-copy documents circulating and hence this office is not superior to other cases in terms of spaciousness.

### 3.12. *Case twelve: Two teams sharing an open plan office in a government department*

The government department had many different offices for its different sections. However, the space allocation and design had to follow the general governmental fitting out guidelines like all other departments. In the office under review, two teams shared one single office with respective team heads taking up cellular offices. General members of staff were accommodated according to functions and all worked in cubicles with medium height partitions. The job nature involved inspection and investigation, processing of confidential information and exhibits. Reporting and discussion were generally done in conference rooms and section head rooms. Staff used various means to block views of their workstations as they preferred to work with privacy. A clear delineation among teams was preferred because of the sensitive and confidential nature of the work tasks. The arrangement of sharing office spaces among various teams was not preferred by the staff.

## 4. Discussion and conclusion

The top managements of private international firms are increasingly becoming transient, as shareholders, who can appoint directors, are not specific individuals but corporations. Face-to-face or even voice contact with responsible persons in a firm is increasingly hard, if at all possible, as the system does not often assign a dedicated person to handle specific cases. The rationale is cost cutting. However, an ignored cost is the *transaction costs* of *poor coordination* among colleagues and between colleagues and clients due to lack of dedicated work spaces. A client that needs to make another inquiry, for instance, has to repeat his/her case history each time s/he contacts the customer service person. All may go fine until a big management disaster based on this system occurs. The drive to open space is seldom a real personally considered decision by a new manager but, rather, a corporate decision nurtured by promoters, who have a stake or can gain an advantage from the trend. This tends to ignore either scientific studies about workers responses or their preferences. Even well supported eulogies for open plan layout, for instance [38], have caveats that call for a “human-centered approach to interior design” in order to be successful.

Granted that communications are essential to organisations, as pointed out by Nielsen [39], and an open plan office layout is potentially beneficial to “promoting communication”, the above 12 cases shed some light on the need for the proper facilities to make open plan offices as “successful” as might be possible. The provision of a common area dedicated to professional chat in the first case and sun screens in the first two cases are deemed suitable. Some basic low partitions and cabinets are essential for the third. Case 4 and Case 6 show that changing the layout from traditional bullpen office to a more open layout might not be welcomed by staff, in particular to the middle management because they were used to working in cellular offices and such a change was deemed to downgrade them. For some traditional and hierarchical companies as in Case 7 and Case 8, mixed workstations with cellular offices and cubicles are needed to differentiate positions and teams. Different job natures also have different requirements for office layouts as discussed in Case 9 and Case 11. A more open layout would be welcomed in the former case while more private space would be needed in the latter case because of the sensitive nature of the job. Case 10 and Case 12 reflected that sharing an open office among teams might affect communication and

productivity, which are also key considerations for all companies. All these point to the need for a management review before and after adopting any open space design.

There is also a fire safety aspect that designers of large open plan offices need to consider: the provision of a protected fire escape corridor to the escape doors. In Hong Kong, the Buildings Department gave clear guidelines in the 2015 code of practice regarding fire escapes. One can see that such corridors, if they are to be clear in an emergency and instantly identifiable, especially given the need to allow for reduced visibility because of smoke, could significantly effect optimising a design for employee welfare and work interaction. This is a marked contrast, of course, to the doors-and-corridor format of a traditional office with obvious escape routes.

Many banks in Hong Kong have also modified the office facilities of their retail services from high security to low-security. Facility managers seem to have assumed that bank robberies that harm tellers are no longer typical. This may have to do with the fact that many money transactions are done online and the actual handling of a large amount of cash in any branch is something of the past. Until another major fatal incident occurs, this mindset will likely remain the norm. Now, signs and steps of a reversal can be observed, if for quite different reasons in the wake of a new wave of civil unrest against China that commenced in June 2019.

In this connection, Case four does open a further issue of which the authors are aware, but which the present exercise has ignored because of time and resource constraints. This is the issue of a multinational or pluri-national company, with its fundamental working practice ethos set down by its parent headquarters in country A, imposing a 'corporate' office layout consistent with the working practice ethos of A, but possibly in conflict with the working practice ethoses of regional offices in countries B, C or D.

From an economic perspective, the overriding consideration of company directors in favour of open plan offices is to reduce expensive space consumption due to office partitioning and desks occupied only part of the time, while keeping hold of office furniture and paper documents. The human costs and risks that could stem from this cost-saving approach are hard to assess numerically. Facility managers often have no choice but to execute what management has resolved to implement. In a sense, they really have to make it "less hated" by workers! [40].

Yet, some basic facilities must be provided or else the office may not function effectively. It is the main conclusion of this short paper that lighting and noise controls are the basic functional, if not humanitarian needs that a properly managed open plan office facility must satisfy.

Some minor improvisations in an open plan layout to provide some measures for privacy can also help increase staff satisfaction with the office environment, as shown in a study by Langer et al. of a UK firm [41]. Linear desks were replaced by circular hub desks, and larger unshielded desks were replaced by smaller desks with partial partitions in the surrounding.

Though this study did not obtain any direct finding on job satisfaction in relation to open plan layouts, the 12 cases do show that the information providers in general had a negative attitude towards such layouts and an adverse reaction to the senior management that was seen to have decided to replace a former more enclosed design, often with no or minimal consultation.

This study is constrained by resources and the need to protect the confidentiality of the names of the 12 organisations. However, it should provide useful information about staff reactions to open space layouts marketed by their commercial providers. It is very nice to say "it all depends on design" and that any change will be "human-centred". The reality is more often that staff, including the facility manager, have no actual say in either the choice or design of their workplace. Further study on this institutional arrangement should shed more light on question of open space offices in a given setting, apart from purely technical health or ergonomic considerations. Workers are people, not human resource units.

### Conflict of interest

None to report.

### References

- [1] Ames P. Hot-desking: Hot or not? *Management today*. 2015 <https://www.managementtoday.co.uk/hot-desking-hot-not/article/1334680>
- [2] Alchian AA, Demsetz H. The property right paradigm. *The Journal of Economic History*. 1973;33(1):16-27.



- [3] Miller NG. Workplace trends in office space: Implications for future office demand. *Journal of Corporate Real Estate*. 2014;16(3):160-80.
- [4] Laing A. The shrinking HQ: can cost cutting allow for innovation? *Facilities*. 1990;8(8):17-20.
- [5] Locke J. An essay concerning human understanding. Kay & Troutman; 1847.
- [6] Ono E, Nozawa T, Ogata T, Motohashi M, Higo N, Kobayashi T, Ishikawa K, Ara K, Yano K, Miyake Y. Fundamental deliberation on exploring mental health through social interaction pattern. In 2012 ICME international conference on complex medical engineering (CME) 2012 Jul 1 (pp. 321-326). IEEE.
- [7] Lee YS. Office layout affecting privacy, interaction, and acoustic quality in LEED-certified buildings. *Building and Environment*. 2010;45(7):1594-600.
- [8] Lee YS, Guerin DA. Indoor environmental quality differences between office types in LEED-certified buildings in the US. *Building and Environment*. 2010;45(5):1104-12.
- [9] Shahzad S, Brennan J, Theodossopoulos D, Hughes B, Calautit JK. A study of the impact of individual thermal control on user comfort in the workplace: Norwegian cellular vs. British open plan offices. *Architectural Science Review*. 2017;60(1):49-61.
- [10] Oldham GR, Brass DJ. Employee reactions to an open-plan office: A naturally occurring quasi-experiment. *Administrative Science Quarterly*. 1979:267-84.
- [11] Pejtersen J, Allermann L, Kristensen TS, Poulsen OM. Indoor climate, psychosocial work environment and symptoms in open-plan offices. *Indoor Air*. 2006;16(5):392-401.
- [12] Pejtersen JH, Kristensen TS, Borg V, Bjorner JB. The second version of the Copenhagen Psychosocial Questionnaire. *Scandinavian Journal of Public Health*. 2010;38(3\_suppl): 8-24.
- [13] Pejtersen JH, Feveile H, Christensen KB, Burr H. Sickness absence associated with shared and open-plan offices—a national cross sectional questionnaire survey. *Scandinavian Journal of Work, Environment & Health*. 2011:376-82.
- [14] Allermann L, Pejtersen J, Gunnarsen L, Poulsen OM. Building-related symptoms and inflammatory potency of dust from office buildings. *Indoor air*. 2007;17(6):458-67.
- [15] Danielsson CB, Bodin L. Office type in relation to health, well-being, and job satisfaction among employees. *Environment and Behavior*. 2008;40(5):636-68.
- [16] Haapakangas A, Helenius R, Keskinen E, Hongisto V. Perceived acoustic environment, work performance and well-being—survey results from Finnish offices. In 9<sup>th</sup> International congress on noise as a public health problem (ICBEN) 2008 Jul 21 (Vol. 18, No. 8).
- [17] Lindholm AL. Identifying and measuring the success of corporate real estate management. *Teknillinen korkeakoulu*; 2008.
- [18] Kaarlela-Tuomaala A, Helenius R, Keskinen E, Hongisto V. Effects of acoustic environment on work in private office rooms and open-plan offices—longitudinal study during relocation. *Ergonomics*. 2009;52(11):1423-44.
- [19] Bergström J, Miller M, Horneij E. Work environment perceptions following relocation to open-plan offices: A twelve-month longitudinal study. *Work*. 2015;50(2):221-8.
- [20] Kim J, De Dear R. Workspace satisfaction: The privacy-communication trade-off in open-plan offices. *Journal of Environmental Psychology*. 2013;36:18-26.
- [21] Lee PJ, Lee BK, Jeon JY, Zhang M, Kang J. Impact of noise on self-rated job satisfaction and health in open-plan offices: a structural equation modelling approach. *Ergonomics*. 2016;59(2):222-34.
- [22] Meijer EM, Frings-Dresen MH, Sluiter JK. Effects of office innovation on office workers' health and performance. *Ergonomics*. 2009;52(9):1027-38.
- [23] Rasila H, Rothe P. A problem is a problem is a benefit? Generation Y perceptions of open-plan offices. *Property Management*. 2012;30(4):362-75.
- [24] Seddigh A. Office type, performance and well-being: A study of how personality and work tasks interact with contemporary office environments and ways of working (Doctoral dissertation, Department of Psychology, Stockholm University).
- [25] Danielsson CB. Office type's association to employees' welfare: Three studies. *Work*. 2016;54(4):779-90.
- [26] Bernstein ES, Turban S. The impact of the 'open' workspace on human collaboration. *Philosophical Transactions of the Royal Society B: Biological Sciences*. 2018;373(1753):20170239.
- [27] Morrison RL, Smollan RK. Open plan office space? If you're going to do it, do it right: A fourteen-month longitudinal case study. *Applied Ergonomics*. 2020;82:102933.
- [28] Costa AP, Villarouco V. Ergonomic analysis of the use of open-plan offices in Brazilian public sector offices. *Work*. 2012;41(Supplement 1):3781-7.
- [29] Roper KO, Juneja P. Distractions in the workplace revisited. *Journal of Facilities Management*. 2008;6(2):91-109.
- [30] Maher A, von Hippel C. Individual differences in employee reactions to open-plan offices. *Journal of Environmental Psychology*. 2005;25(2):219-29.
- [31] Virjonen P, Keränen J, Hongisto V. Determination of acoustic conditions in open-plan offices: proposal for new measurement method and target values. *Acta Acustica united with Acustica*. 2009;95(2):279-90.
- [32] Calisi C, Stout, J. Stop noise from ruining your open office. *Harvard Business Review*, 2015: <https://hbr.org/2015/03/stop-noise-from-ruining-your-open-office>.
- [33] Haapakangas A, Kankkunen E, Hongisto V, Virjonen P, Oliva D, Keskinen E. Effects of five speech masking sounds on performance and acoustic satisfaction. Implications for Open-Plan Offices. *Acta Acustica*. 2011;97(4):641-55.
- [34] Hongisto V, Haapakangas A, Varjo J, Helenius R, Koskela H. Refurbishment of an open-plan office—environmental and job satisfaction. *Journal of Environmental Psychology*. 2016;45:176-91.
- [35] Keränen J, Hongisto V. Prediction of the spatial decay of speech in open-plan offices. *Applied Acoustics*. 2013;74(12):1315-25.
- [36] Shafaghhat A, Keyvanfar A, Lamit H, Mousavi SA, Majid MZ. Open plan office design features affecting staff's health and well-being status. *Jurnal Teknologi*. 2014;70(7).
- [37] Wolkoff P. Indoor air pollutants in office environments: assessment of comfort, health, and performance. *International Journal of Hygiene and Environmental Health*. 2013;216(4):371-94.
- [38] Candido C, Chakraborty P, Tjondronegoro D. The rise of office design in high-performance, open-plan environments. *Buildings*. 2019;9(4):100.
- [39] Nielsen C. How Microsoft used an office move to boost collaboration. *Harvard Business Review*, 2016:

- <https://www.google.com/search?q=How+Microsoft+Move+Nielsen&ie=utf-8&oe=utf-8&client=firefox-b-ab>
- [40] Pearce B, Hinds B. How to make sure people won't hate your new open office plan. Harvard Business Review, 2018. <https://hbr.org/2018/01/sgc-research-when-moving-to-an-open-office-plan-pay-attention-to-how-your-employees-feel>
- [41] Langer J, Smith AP, Tylour J. Occupant psychological wellbeing and environmental satisfaction after an open-plan office redesign. Charles, R. & Golightly, D. (eds), Contemporary Ergonomics and Human Factors 2019. Chartered Institute of Ergonomics and Human Factors. pp. 223-233. ISBN: 978-1-9996527-1-5.