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# **The Impact of Office Layout on Productivity**

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## **Abstract:**

**Purpose** – The aim of this paper is to evaluate the impact office layout has on office occupiers' productivity.

**Design/methodology/approach** – The author evaluates the literature that claims to make a linkage between office layout and the affect on office occupiers' productivity. Two main themes are developed. Firstly, the literature that links office layout to work patterns is evaluated, and secondly the open-plan versus cellular office debate is developed.

**Findings** – The review of the literature reveals that the connection between the three major components of office layout, office occupier work patterns and productivity is not clearly established.

**Originality/value** – The paper establishes that there is a requirement to link together office layout to the work patterns of office occupiers. It is only when the connection is made between the office layout and office occupiers work patterns that productivity gains can be achieved. To support the different work patterns undertaken the facilities manager can create office environments that consist of a balance between private space as well as communal shared space. The amount of balance will be very much dependent on the mix of work patterns in the office.

**Keywords:** Workplace, Office productivity, Office evaluation, Office layout

**Paper Type:** Literature Review

## **Introduction**

This paper aims to review the literature that claims to link the layout of the office environment to the productivity of its occupants. The office layout discussion will include the open-plan versus cellular office debate, and also the matching of the office environment to different work patterns. The difficulty in evaluating the literature is connected to consistency. It is clear that whilst terms such as open-plan offices and cellular offices are used frequently, there does not appear to be universally accepted definitions of these terms. Similarly the term productivity is used, although the definition and means of measurement still remains ill defined (Haynes, 2007a).

The debate in the literature that attempts to link the layout of the office environment and the performance of the occupiers tends to centre around the issue of open-plan versus cellular offices (Haynes et al, 2000), and attempts to match the office environment to the work processes (Stallworth & Ward, 1996; Laing et al, 1998; Mawson, 2002). International architectural firm, Gensler (2005), highlight the financial impact of poorly designed offices claiming that:

“Poorly designed offices could be costing British business up to £135 billion every year.”  
 (Gensler, 2005)

Gensler (2005) identified six themes from their research. A summary of these and some of the major findings are highlighted in Table 1.

**Table:1 Summary of Gensler research findings**

THEME	
The productivity leap	A better working environment would increase employee productivity by 19%
Workplace matters	Four out of five (79%) professionals say the quality of their working environment is very important to their sense of job satisfaction
Brand control	Professionals are split 50/50 as to whether their workplace enhances their company’s brand
Work styles / workspaces	Personal space (39%), climate control (24%) and daylight (21%) are the most important factors in a good working environment according to professional surveyed
The creative office	38% of professionals believe it’s difficult to be creative and innovative in their office
The “Thinking Time” directive	78% of professionals say increasing work pressure means they have less time to think than 5 years ago

The research by Gensler (2005) identifies the impact the office working environment has on improving productivity (potentially a 19% increase) and job satisfaction (79% of respondents linked their environment to their job satisfaction). Gensler (2005) establish a linkage between the working environment, human resources and business strategy.

“Working environment has a fundamental impact on recruitment, retention, productivity and ultimately on the organisation’s ability to achieve its business strategy” (Gensler, 2005)

The research by Gensler (2005) was based on a survey of 200 middle and senior managers in the legal, media and financial sectors. It is acknowledged however, that this is not a large sample size, and the sample measures the perceptions of professionals and not direct measurements of productivity. Finally, the £135 billion cost to British businesses was based on a 19% increase in the UK service sector Gross Added Value. Whilst the actual value of productivity loss can be questioned, Gensler identified a clear need for research that investigates the link between productivity and office layout. Through a succinct literature review, this paper demonstrates the complexity that researchers have to address in establishing a link between office layout and productivity.

## Office layout and organisational performance

Research that investigated the impact of open-plan measures and the effectiveness of facilities space management was undertaken by Ilozor & Oluwoye (1999). They collected data from 102 open-plan offices from commercial office buildings in the central business district of Sydney, Australia. The data were collected using a questionnaire design, and completed by the facilities manager responsible for the office environment. Ilozor & Oluwoye (1999) presented a conceptual model that attempts to link the following variables:

- i) Open-plan Measures
- ii) Management Control, and
- iii) Effectiveness of Facilities Space Management

In assessing staff productivity Ilozor & Oluwoye (1999, p239) used the following question, which was scaled either yes or no, in their assessment on the effectiveness of facilities space management:

| *"Practice of measuring staff productivity"*

Ilozor & Oluwoye (1999, p244) concluded their analysis by stating that:

| *"A greater perceived support on informal meetings by open-plan workspace is associated with increased measuring of staff productivity."*

Whilst this research appears to offer evidence for a more productive workplace, care needs to be taken in how far the results can be generalised. Firstly, the study was undertaken in the business district of Sydney, and therefore any generalisation would have to be confined to similar commercial offices. Secondly, the productivity question only assesses if the office adopts a staff productivity measure, not a productivity measure in itself. Finally, and probably the main limitation of the research, the respondents were facilities managers and not the actual occupants of the office environments.

Ilozor et al (2002) attempted to make the connection between the use of innovative work settings and improved organisational performance. The research was based on 102 work settings, with several null hypotheses on innovative work settings and organisational performance being tested for statistical differences using the Kruskal-Wallis H test. In contrast to previous published research (Ilozor & Oluwoye, 1999) Ilozor et al (2002) included a measure of the level of productivity. Although they do not make clear how the level of productivity was actually measured.

One of the conclusions drawn by Ilozor et al (2002) was that:

| *"The more a work setting is perceived to be innovative in terms of fostering staff interaction, the greater the measuring of staff productivity and the level of productivity." (Ilozor et al, 2002)*

This conclusion illustrates the use of innovative environments as a means of enabling greater interaction between office occupiers. This result also starts to give an indication as to the ingredients required when considering a creative and productive workplace. Ilozor et al (2002) concluded that the physical properties of the office environments can be used to influence organisational performance. Whilst this analysis is more developed than previous research undertaken (Ilozor & Oluwoye, 1999) it does suffer from the same main critique, which is that the data appear to be collected from facilities managers and not from the office occupiers themselves.

Changing the workplace environment as an aid to organisational change is supported by Allen et al (2004). They evaluated a number of UK Government case studies and propose that the workplace layout can be used to increase collaboration and openness, thereby enabling improved organisational performance.

The notion that the workplace should not hinder an organisation's ability to respond to the changing business world was developed by Bradley & Hood (2003). They developed the idea of workspace flexibility (Becker, 2002) by proposing a minimalist approach to office design. Their main proposal was the need to keep the office free of clutter, which can restrict the organisation's ability to adapt and respond quickly to market forces. Bradley & Hood (2003) proposed that to ensure the workplace improves corporate agility four golden rules should be adopted:

- i) Systematically and frequently purge 'stuff' to enable mobility
- ii) Design for 'busyness' in order to keep a 'buzz'.
- iii) Reduce bespoke fixed fit-out components and adopt re-locatable components
- iv) Systematically evaluate the utilisation of space and technology along side shifting work practices.

Whilst it may appear that the four golden rules represent good house keeping, the final golden rule supports the notion that the office environment should be designed, and adapted, to support the work processes, the aim being to minimise the mismatch between the office environment and the work processes (Mawson, 2002).

### **Aligning office layout and work processes**

Previously, authors such as Stallworth & Kleiner (1996) have talked about "*Person-environment fit*" (p36), and Mawson (2002) claimed that productivity losses could be attributed to a mismatch between the office environment and the work undertaken in that environment.

*"Contrast this with the approach taken to designing a manufacturing plant where detailed consideration would be given to the processes to be performed within the building, before then designing back from these to get the best fit." (Mawson, 2002, p1)*

Research undertaken by DEGW and Building Research Establishment (BRE) attempted to address the issue of matching the work processes and the office environment (Laing et al, 1998). The research question adopted was:

*"Most office buildings and their environmental systems were designed for typical 9 to 5 activities, but how will they perform when that pattern of use changes?" (Laing et al, 1998, p1)*

The research undertaken attempted to address the issue of organizational work patterns and the working environment. Three components (affinities) were investigated in greater detail:

i) Work Patterns

ii) Building Types

iii) HVAC Systems

The results included an assessment of the three components (affinities), to identify the optimum correlation of the working environment for the work patterns.

To help in understanding the various work patterns four new metaphors were developed by Laing et al (1998, p21-p24). They were:

**Hive:** *"The hive office organization is characterized by individual routine process work with low levels of interaction and individual autonomy. The office worker sits at simple workstations for continuous periods of time on a regular 9 to 5 schedule (variants of this type include 24-hour shift working.)"*

**Cell:** *"The cell office organization is for individual concentrated work with little interaction. Highly autonomous individuals occupy the office in an intermittent irregular pattern with extended working days, working elsewhere some of the time (possibly at home, at clients, or on the road)."*

**Den:** *"The den office organization is associated with group process work, interactive but not necessarily highly autonomous. The space is designed for group working with a range of several simple settings, typically arranged in the open-plan or group room."*

**Club:** *"The club office organization is for knowledge work: both highly autonomous and highly interactive. The pattern of occupancy is intermittent and over an extended working day. A variety of shared task based settings serve both concentrated individual and group interactive work."*

Laing et al (1998) used the work patterns to suggest four correspondingly different physical environments, with the inference that an optimal match between process and environment can be made. Laing et al (1998) offered a simple model to represent office-based work. The model was based on the amount of face-to-face interaction in the office, and the amount of flexibility the occupier has to work when, where and how they wish, i.e. autonomy. The limitations of this work, as acknowledged by the authors, was that the results were based on a small-scale study i.e. eight case studies. Also whilst the research addressed the issue of the working environment and the work processes, it did not directly address the working environment and workplace productivity.

In an attempt to include the productivity measurement, Haynes (2005) adopted the work pattern categories proposed by Laing et al (1998) and evaluated the impact of office layout on office occupiers' perceived productivity. Applying ANOVA tests to the four different work patterns identified the transactional knowledge worker grouping to be a statistically significant different grouping, and the only work pattern to perceive their office layout to be having a positive effect on their productivity (Haynes, 2005). All the other work pattern categories perceived office layout to be generally having a negative impact on their productivity (Haynes, 2005). This result on its own has a large implication, as it indicates a mismatch between the office environment and the work undertaken in the office (Mawson, 2002). It can be concluded that office environments are being designed without a detailed appreciation of the occupiers' proposed use of space (Peterson & Beard, 2004). An opportunity exists to ensure that office occupiers are consulted at all stages of the design process to ensure that the optimum office layout is achieved (Burke & Chidambaram, 1999; Laframboise et al, 2003).

### **Open-plan versus cellular offices**

BOSTI associates, led by Michael Brill, have undertaken two major pieces of research into the effects the workplace has on worker performance. The first piece of research took place in the 1980's and collected data from 10,000 workers in 100 organisations. The findings of this study were published in a two volume publication entitled "*Using Office Design to Increase Productivity*" (Brill et al, 1985). The second piece of research took place between 1994 and 2000 and created a database of 13,000 cases (Brill et al, 2001). This second wave of research acknowledged that much had changed. The four main trends that were driving workplace changes were identified as (Brill et al, 2001, p 5):

- Organisational structure and strategies
- Workforce attitudes and expectations
- Technology – its ever increasing power and widespread deployment
- New recognitions about, and strategies for, the workplace

Included in the second piece of research were evaluations of individual performance, team performance and job satisfaction. With regards to office setting the study collected data on single-occupant rooms, double-occupant rooms and open plan office. In addition, Brill et al (2001, p 17) proposed some useful definitions for their research.

*Workplace: A general term for the entire physical environment for work....the whole floor, whole building, and whole campus. The work-place always contains large numbers of workspaces.*

*Workspace: The space where an employee sits (mostly) when in the office*

*Private (Cellular) Office: A workspace that has four walls to the ceiling and a door*

*Open (Plan) Office: A workspace whose perimeter boundaries do not go to the ceiling*

Brill et al (2001, p19) proposed that analysis of the full data set identified ten of the most important workplace qualities in rank order.

1. Ability to do distraction-free solo work
2. Support for impromptu interactions
3. Support for meetings and undistracted group work
4. Workspace comfort, ergonomics and enough space for work tools
5. Workspace side-by-side work and “dropping in to chat”
6. Located near or can easily find co-workers
7. Workplace has good places for breaks
8. Access to needed technology
9. Quality lighting and access to daylight
10. Temperature control and air quality

The top two workplace qualities relate to the specific work processes. Office workers want to be able to undertake distraction-free solo work but also value the opportunity to have an informal interaction with colleagues. Haynes (2007b) provided supporting evidence by identifying distraction as the component to be having the most negative impact on perceived productivity and interaction to be having the most positive impact on perceived productivity.

Clearly there can be tensions in an office environment to allow individual private working to co-exist with collaborative team based working.

Brill et al (2001, p 26) explored the issue of distraction further by investigating the amount of distraction by office type.

**Table: 2 Type of office and distraction by other peoples conversations (Adapted from Brill et al, 2001)**

	Rarely distracted	Frequently distracted
Single-room occupant	48%	29%
Double-room occupant	30%	52%
Open plan office	19%	65%

Table 2 illustrates that increasing the number of occupants in an office environment increases the amount of reported distraction caused by other people’s conversations. Becker (2004) shared the same concerns as Brill et al (2001) with regards to open plan environments, especially open-plan environments that contain cubicles:

*Research by Michael Brill and his associates as well as our own studies show that despite all the furniture, technical and social fixes that been tried to render cubicles more acceptable to employees, on the whole cubicles flunk. (Becker, 2004, p 25)*



BOSTI Associates made the following claim, having analysed all the data from their vast database.

*The really groovy, wide-open office, with folks shown interacting informally all day is a visually seductive myth. Research shows it doesn't support work very well and, in fact, can incur significant losses in individual and team performance and job satisfaction. (Brill et al 2000, p36)*

Brennan et al (2002) presented findings from a longitudinal study that aimed to evaluate the transition of office occupiers from traditional cellular offices to an open-plan office environment. The measurement intervals adopted were before the move, four weeks after the move and six months after the move. Although 80 questionnaires were distributed at the interval points, only 21 participants responded to all three intervals. Acknowledging the small sample size as one of the limitations of the study, the results have the benefit of being time series. The study included measures of satisfaction with the physical environment, physical stress, relations with team members and perceived performance. The performance measure adopted was a self-assessed measure, but had the benefit of being assessed on a 20-item scale.

*"Perceived performance was assessed through a 20-item subscale consisting of items such as 'I am able to stay focused and 'on task' at work' and 'I am able to complete my planned tasks for the day.'" (Brennan, Chugh & Kline, 2002, p289)*

The main conclusion drawn from the study was that the office occupiers were dissatisfied with their move to a new open-plan environment, and that dissatisfaction did not improve after the six-month adjustment period. Brennan et al (2002) concluded that the respondents found the openness of the environment counter productive in terms of increased disturbance and distractions. One of the limitations of the study was that the respondents were not subdivided into different work process; therefore comparisons between work processes could not be made. One of the main limitations of the study, acknowledged by the authors, was the lack of a control group. The inclusion of a control group would have allowed comparisons between the test group and the control group to be made. Therefore the comparisons would have established if the dissatisfaction was as a cause of the open-plan environment, or as a result of an intervening variable such as organisational issues.

The office environment can be used to establish brand identity, as well as a tool to attract and retain quality staff (Becker, 2002). Becker (2002) argued that the layout and use of the office can also provide workplace flexibility, thereby allowing firms to change and adapt without being restricted by office space. Moreover, Becker argued that open-plan environments are a less expensive solution over time, as they require minimum alteration since occupiers can adopt a 'hotelling' policy. The idea of 'zero-time' space solution was introduced with the principles being that the space does not change over time, but the space policy does, i.e. employee desk ratio. Whilst Becker (2002) advocated non-territorial offices, no viable office protocols were presented (Laframboise et al, 2003). It should also be acknowledged that whilst Becker's (2002) idea of a non-territorial office with everyone adopting a hotelling policy may sound attractive in providing the organisation with workplace flexibility, none of the firms studied actually adopted hotelling practices (Becker, 2002).

## Aligning office layout and human behaviour

The trend towards open-plan environments has largely been driven by organisations aiming to reduce accommodation costs (Marquardt et al, 2002; Veitch et al, 2002; Haynes, 2007c). Veitch et al (2002) argued that facilities managers have responded to such pressure by creating open-plan environments with reduced space allocations. They suggested that by adopting the cost reduction paradigm, organisations run the risk of creating office environments that are ultimately uncomfortable and unworkable. Veitch et al (2002) maintained that the effects on the individual could be direct, caused by adverse physical conditions, or indirect through psychological process such as lack of privacy or stress.

To establish the effects of the open-plan environment on occupier satisfaction Veitch et al (2002) collected data from 419 respondents located across three government offices. Both physical measurements were made, such as temperature, lighting, noise, ventilation and workstation details, as well as occupiers completing a 27-item questionnaire. The questionnaire consisted of 18 questions relating to satisfaction with the environment, 2 questions relating to overall satisfaction with the environment and two questions relating to job satisfaction.

**Table: 3 Satisfaction with environment: A three - factor model (Adapted from Veitch *et al*, 2002)**

Satisfaction	Items
Satisfaction with Privacy:	visual privacy, conversational privacy, amount of noise from others' conversations, amount of background noise; amount of distraction, workstation size, degree of enclosure, ability to alter conditions; distance between coworkers; and aesthetic appearance.
Satisfaction with Lighting:	lighting quality, quantity of light on the desk, quantity of light for computer work, computer glare, and access to a view.
Satisfaction with Ventilation:	air quality, temperature, and air movement.

Using factor analysis Veitch et al (2002) created a three-factor model to represent the satisfaction with the open-plan office environments (Table 3). Whilst the lighting and ventilation factors clearly represent satisfaction with the physical environment, the inclusion of the privacy component broadens the debate to include the behavioural environment (Haynes, 2007d).

Whilst the espoused organisational benefits of open-plan environments relate to improved teamwork and communication (Van der Voordt, 2004) the actual effects experienced by the occupier can be that of increased crowding and loss of privacy.

*“Open-plan and shared offices have most complaints about lack of privacy – people have difficulty concentrating, dealing with personal matters and colleagues’ annoying habits.”*  
(Nathan & Doyle, 2002, p26)

Nathan and Doyle (2002) acknowledged that reducing the space allocation of individuals in the office environment can have both a positive and negative effect on office occupier's ability to do their jobs. The effect on the office occupier will be dependent on the complexity of the task involved.

*“High density environments- or environments that people feel are crowded – seem to make complex tasks harder to do. But simple tasks become easier to do.” (Nathan & Doyle, 2002, p26)*

The effects of open-plan environments are acknowledged by Van der Voordt (2004), who proposed that office occupiers in an open-plan environment experience an increase in stimuli, both visual and acoustic, than occupiers working in enclosed cellular offices. He further proposed that office occupiers can respond in different ways to the increase in stimuli, with some perceiving the increase in stimuli in a positive ways, whilst others perceive the increase in stimuli as a mental burden that raises their stress levels (Van der Voordt, 2004).

Whilst the aim of a high performance workplace would be to match the requirements of the individuals, and their work process, to the physical environment, the consequences of creating an office environment which is a mismatch could have an effect on both the health of the individual and their performance levels.

*“Badly-designed or managed workplaces damage staff physical and mental well being” (Nathan & Doyle, 2002, p2)*

Van der Voordt (2004) evaluated two Dutch case studies that had attempted to measure the effects of innovative workplace design on productivity. Whilst Van der Voordt (2004) identified the potential weakness of using perceptual measures of productivity, and calls for a number of indicators to be used, the case studies used adopted a perceived productivity measure. One of the case studies reported an increase in perceived productivity, with the others reporting a decrease in productivity. Van der Voordt (2004) concluded that the differing responses can partly be explained by different initial situations. Although it is not explicitly stated, it appears that the inference is that the case study reporting a positive result was initially in an open-plan environment, whereas the negative case study was probably in cellular offices. This clearly illustrates the need to integrate a change management process into a relocation project (Laframboise et al, 2003).

From the results of the case studies, and a workshop exercise with experts, Van der Voordt (2004) presented a summary of the positive and negative effects on work processes of innovative workplaces (Table 4).

**Table:4 Productivity effects on work processes (Van der Voordt, 2004)**

<b>Positive</b>	<b>Negative</b>
Free choice of appropriate workplace	More time spent on organising work
Culture change: work more consciously	Loss of time used for installation (logging on, adjusting furniture, tidying up)
Stimulus to work in a more organised way	Acclimatising time and again (different workplace; varying colleagues next to you)
No space for saving things, so you have to finish them	More time required to look up and store information

Van der Voordt (2004) attempted to address two major issues which are specifically related to office layout. Firstly, it was proposed that there is an increase in shared areas, and a reduction in fixed dedicated workplaces. This approach replicated the ideas of a non-territorial office as presented by Becker (1990). The second issue addressed relates to the debate between open-plan versus cellular offices, where Van der Voordt (2004) acknowledged the advantages and disadvantages of each environment. He concluded that it is important to create an environment that allows occupiers to transfer information, whilst also accepting that there is a requirement for concentrated work. To resolve the potential tensions between the work process demand and the office environment provision Van der Voordt (2004) proposed the use of a combi-office.

*"One of the main reasons for using combi-offices, with a mix of shared and activity-related workplaces, has been to overcome the disadvantages of office units (too closed, poor conditions for social interaction) and open-plan offices (too open, too many distractions)." (Van der Voordt, 2004, p145)*

The combi-office approach appears to address the concerns of mismatching the office layout and the work processes; it even offers a potential solution to the behavioural issues. However, establishing the right balance of private and shared areas requires a detailed evaluation of user needs. Once the space is created, there will be an additional demand to constantly evaluate and manage the office space. This highlights a need for active workplace management to ensure that the office environment constantly remains supportive of organisational and individual needs.

## **In Conclusion**

The office layout literature can be subdivided into two key themes:

1. literature that addresses the open-plan versus cellular office debate; and
2. literature that matches the office layout to the work patterns of its occupants.

Whilst the open-plan versus cellular office debate can tend to reinforce the prevailing paradigm of cost reduction (more people in less space), the issues of matching the office

layout to different work patterns develops the human contribution debate (CABE, 2005; Haynes, 2007c). This changing emphasis allows consideration to be given to understanding how office occupiers actually use space. This view of office environments from the occupier perspective opens up an appreciation of the behavioural environment (Haynes, 2007d). It is starting to emerge that any theoretical framework for office productivity must consist of both the physical environment and behavioural environment, and in addition must accommodate the different work patterns that office occupiers can adopt.

There is a clear need for a unifying measure of office productivity (Haynes, 2007a). The lack of a universally accepted measurement of productivity means that like for like comparisons of research projects are limited. It is proposed that in the absence of a quantifiable productivity measurement, a self-assessed measure is a justifiable consideration (Haynes, 2008)

To increase the transparency for research findings there is a need for office productivity researchers to be explicit with regards to their definitions of the office environment. Ideally, universally accepted definitions of private office, grouped office and open-plan offices would assist in this matter. It should also be accepted that the definitions should not be restricted to the number of people working in the environment but also include their level of office density.

Categorising office occupiers by their actual work process is a useful way of identifying the need of office occupiers. The interaction versus autonomy model proposed by Laing et al (1998) allows four distinct work patterns to be identified. However, further research is required to establish if these work patterns can be further sub-divided, enabling a wider range of work patterns to be developed, and including possible future trends. In addition, other categories could be established by taking into account the personality type and the team role type of the office worker (Haynes, 2007b).

Once clearer classifications of work patterns and preferred work styles are obtained, evaluations of different settings against the work patterns can be undertaken. However, to enable linkages to be made between the work setting and the work pattern, consideration needs to be given to the management of the office space. The aim being to establish if the office environment is being actively managed through office protocols and office productivity evaluations.

There is a need to research how organisational culture, more specifically office culture, and management style link to office productivity. The development of management style and cultural metrics would greatly assist in understanding the behavioural environment. Aligned to this kind of research, and a possible linkage between the physical environment and the behavioural environment, would be an evaluation of how cultural cues are sent through the use of the physical environment.

An area that needs further research is the balance between individual private working and collaborative team-based working. This type of research would require a greater understanding of the social dynamics within an office environment. To aid this understanding consideration would have to be given to the social and behavioural networks created in an office environment.

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