

Building a business case

Nigel Oseland and Adrian Burton summarise their research into developing a method to quantify the effect on worker performance of improvements to the office environment.

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Demonstrating the impact of office design on productivity has often been referred to as the elusive "holy grail", owing to its being difficult to prove². However, there is actually a plethora of research demonstrating the impact of environmental conditions (such as temperature, noise, light and space) and furniture design on performance. The analogy is more akin to the existence of the holy grail being denied even when found, dismissing it as a fake, or more likely not recognising it because it is obscured. Consequently, the majority of UK businesses do not accept productivity benefits as part of the business case for the justification of workplace improvement projects. We set out to develop a practical means of predicting the gain in worker productivity that can be expected following workplace improvements, so that such benefits can be included as part of a business case.

Not only do we not know how much our designs are affecting individual and business performance but we also do not know if they are having a large negative effect on performance.

MEASURING PRODUCTIVITY

Empirical research on the impact of work environments on performance has been conducted since the days of Taylorism in the early 20th century. Taylorism took its name from Frederick Winslow Taylor, an American industrial engineer, who first promulgated scientific management of the work process in a mass production environment whereby every task was broken down into its constituent parts and analysed in order to optimise worker efficiency and thereby increase both production and business profits.

Over the past 15 years there have been many literature reviews, all highlighting the clear effect that workplaces have on individual and business performance, including studies by UK professional bodies the Chartered Institution of Building Services Engineers (CIBSE)³, the British Council for Offices (BCO)/Commission for Architecture and the Built Environment (CABE)⁴ and the Royal Institution of Chartered Surveyors (RICS)⁵. Several of the reviews acknowledge that organisational and motivational

factors are likely to have the biggest impact on performance but nevertheless conclude that environmental factors account for a 5% to 15% change in productivity.

It is well documented that approximately 85% of a business's costs are related to staff salaries, with the remainder comprising office construction and operating costs². This breakdown implies that reducing salary costs by 15% while maintaining performance, or increasing performance for similar salary costs, would cover all office costs. Indeed, several reports quantify productivity by monetising it using average salary costs, but actually the economic benefit should be based on the typical revenue generated by the staff and, as such, productivity gains based on salary costs are conservative.

So there is an abundance of research showing the impact of the working environment on performance, and a tried and tested method of monetising productivity gains. Yet the majority of the UK construction industry does not consider changes in productivity as part of the business case for investment in new office fit-outs or refurbishment projects.

Oseland and Bartlett⁶ found the main reason given for not making such measurements was that it is too difficult to quantify productivity gains and the impact of the workplace on business performance (whether good or bad) is ignored. Thompson agrees, stating in the RICS research: "There is a seemingly endless drive for improved efficiency in the workplace, and a tendency for the performance of property ... to be measured on efficiency grounds alone ... Effectiveness of the workplace receives relatively few column inches of coverage and may even be compromised in a blind drive for efficiency."⁵

Our own discussions found that financial directors are on the whole unwilling to entertain a business case built upon productivity gains as they have little confidence in the results reported in performance studies. In fairness, this attitude is partly justified by the wide range of productivity gains reported in the research. Our own literature review of such research revealed changes in performance ranging from 0.3% to 160%. There is clearly a need to provide productivity data that are acceptable for use in a business case.

The Atomic Weapons Establishment (AWE) has a standard business case process for justifying spend on improving offices for its 6,000 staff. However, the process does not account for any potential change to productivity. The AWE therefore approached us to establish a methodology to account for changes in productivity that would align with a standard business case. A practical tool was needed that

would enable a range of businesses to use a similar approach to determine how building design can affect staff performance. Basically, input variables were required to be used in the business case for office improvements.

LITERATURE REVIEW

We carried out a literature review of the productivity research related to the impact of environmental conditions and office design. More than 200 research papers were reviewed, but the research studies included in the analysis were limited to those that:

- involved experimental research;
- clearly identified dependent and independent variables; and
- reported a measured percentage change in task performance.

We included the experiments of 75 researchers, who between them reported the results of 135 different performance metrics. We acknowledge that the productivity research reviewed is not exhaustive but we believe it is representative of the better-quality research available.

The main environmental factor was identified for each of the research papers in the review. Lighting, noise, temperature, ventilation, personal control, furniture, space and “general” were identified as key factors. “General” refers to studies that explored the impact of all environmental conditions combined, for example a questionnaire survey with an overall satisfaction score. Some of the papers reviewed are studies of multiple independent variables, but they usually have a predominant factor. Once the research findings were compiled, it was evident that the studies varied considerably in approach. It is therefore not surprising that there is such a range of reported productivity gains, as discussed earlier. We identified three broad categories of methodological differences (see table 1).

Environment (category 1)

Category 1 refers to the place where the productivity research was carried out. Much of the earlier research was conducted in industrial settings and many studies are carried out in laboratories or office simulations; there are fewer studies in real offices or call centres. Clearly, the studies carried out in real offices or office simulations are more relevant to the impact of office design on productivity than, say, those carried out in factories.

Measurement (category 2)

Category 2 refers to the metric used to express the change in performance. Much research is based on self-reported performance and fewer studies use performance tasks or embedded business metrics. Another subcategory is HR-related metrics such as absenteeism and staff attrition. Objective measures

TABLE 1: THREE CATEGORIES OF METHODOLOGICAL DIFFERENCES

1. Environment	Weight	2. Measurement	Weight	3. Activity time	Weight
Literature review	39%	Review/Estimate	35%	Manual	1.0%
Survey/Poll	40%	Survey/Opinion	50%	Absenteeism	8.4%
Light industry	46%	Manual task	47%	Heads down	31.9%
Heavy industry	35%	Perceived performance	48%	Paper based	7.9%
Laboratory	40%	Performance task	51%	Attrition	15.7%
Simulation	53%	Absenteeism	67%	PC work	24.0%
Call centre	70%	Attrition	65%	Call centre	79.3%
Office	82%	Business metric	68%	Office	63.5%

such as performance tasks or embedded business metrics are more likely to be favoured by financial directors than the more subjective metrics.

Activity time (category 3)

Category 3 relates to the amount of time that the measurement might be observed in a real office building. For example, performance metrics such as paper-based activities or manual labour may only apply to a small proportion of the typical officer worker’s day. “Heads down” refers to all desk work, which may include a combination of PC- and paper-based work. HR metrics or measurements in real offices would apply just to the time spent in the office, excluding holiday, sickness, training and so forth.

DETERMINING THE EFFECT ON PERFORMANCE

We believe the three factors above affected the relevance of the research studies and their reported changes in productivity. Therefore the research studies were weighted to reflect their relevance to the office environment and our confidence in the reported results. For example, a study of real offices using embedded business metrics should be given more credence than a questionnaire study carried out in a laboratory.

We therefore developed weightings based on expert opinion; we approached the Office Productivity Network (OPN) and asked the members to weight the subcategories of the experimental environment (category 1) and the performance metrics applied (category 2). The mean of the weightings derived from the workshops with the OPN were incorporated into our analysis (table 1).

To weight the activity time (category 3) we referred to a time utilisation survey database. AMA Alexi Marmot Associates used its database of surveys of 140 buildings with 48,000 workspaces to provide us with the mean time spent carrying out PC work, paper-based work, heads-down activity and total time at the desk for general office workers and call centre staff; manual labour was estimated at a notional 1%. We

REFERENCES

¹ Oseland, N A and Burton, A (2012), “Quantifying the impact of environmental conditions on worker performance for inputting to a business case”, *Journal of Building Survey, Appraisal and Valuation*, 1(2), 151–64.

² Morrell, P (2005), *The impact of office design on business performance (summary report)*, CABE/BCO, London.

³ Oseland, N A (1999), *Environmental factors affecting office worker performance: A review of evidence*, CIBSE, London.

TABLE 2: WEIGHTED EFFECT FOR SINGLE FACTOR STUDIES

Factor	Count	Unweighted mean	Weighted effect		
			Mean	Lower Q	Upper Q
Lighting	17	9.5	1.1	0.1	2.0
Noise	10	27.8	1.4	0.2	1.7
Temperature	16	17.0	1.2	0.0	1.9
Ventilation	16	9.0	1.4	0.2	1.7
Control	10	8.0	1.2	0.3	2.1
Furniture	8	15.7	2.1	1.0	2.1
Space	3	24.1	3.5	1.7	4.4
General	22	16.7	2.7	1.2	3.2
Average (excl. General)	80	15.9	1.7	0.1	2.0

calculated the HR metrics, attrition and absenteeism using the Chartered Institute of Personnel and Development's (CIPD) reported benchmark figures⁷. All activity-time figures were adjusted to reflect holiday, training and sick leave.

The weightings of confidence were applied to the measured effect on performance identified in each research study, and the mean and quartile range of this weighted effect was then calculated (see table 2). Most of the single environmental factors had a weighted mean effect on productivity in the order of 1% to 2%. The results for space and general are higher but these studies concerned new office layouts and designs that may genuinely have had a larger effect on performance.

We propose that ranges of the weighted effects for a single environmental factor are used in a business case. At this initial stage of our research, we recommend that the upper quartile value is used in cases where the designers have complete confidence in their design proposals, and we recommend that the mean value is used for less confident proposals. Later, with more development and data, it may be possible to model a specific effect within the quartile range.

Most research studies limit their scope to one factor but, in contrast, new workplace projects will involve changing a number of factors. The analysis of the multi-factor studies in our literature review revealed that the means and ranges are more diverse than for the single-factor studies. We believe the inconsistency in range for the multiple factor studies is due to the lack of data, as there were fewer than 10 studies for each predominant factor. This lack of confidence in the multiple-factor studies places a restraint on the use of our data in business cases. Some researchers have come up with the idea of a simple addition of single factors, but looking at our own results we were not convinced that simply adding the percentage performance increase of single factors would be accepted by financial directors. An alternative method of calculating the impact on performance of combined single factors was therefore required.

REFERENCES

⁴ BCO/CABE (2006), *The impact of office design on business performance (full report)*, BCO, London.
⁵ Thompson, B (2008), *Property in the economy – workplace design and productivity: Are they inextricably linked?* RICS, London.
⁶ Oseland, N A and Bartlett, P (1999), *Improving office productivity: A guide for business and facilities managers*, Pearson Education Ltd, Harlow.
⁷ CIPD (2007), *Annual survey report: Recruitment, retention and turnover*, CIPD, London.

LAW OF DIMINISHING RETURNS

The law of diminishing returns is a universally accepted economic concept and we propose that this law would apply to workplace environments that are being improved through a number of design features. In recent years the Danish Technical University has published three key studies which have attempted to estimate the cumulative effects of combined environmental conditions. We reanalysed the researchers' data and our results indicate that, as a rule of thumb, a second environmental factor may have an effect on performance that is approximately two-thirds (68%) the magnitude of the first factor, and a third factor is likely to have approximately one-third (36%) of the effect. Thus the percentage effect on performance for the single factors could be estimated using the following simple equation:

$$P_o = P_1 + 2/3 P_2 + 1/3 P_3$$

where: P_o = the overall percentage performance change

and: P₁ to P₃ = percentage performance change from the 1st, 2nd and 3rd environmental factors

We fully acknowledge that this equation is based on a belief that the law of diminishing returns applies to performance measurement and a link to the magnitudes of change observed in just three studies. However, until more robust findings and guidance are unveiled, we consider that the equation above is a good enough approximation for practical use in business cases.

JUSTIFYING SPENDING ON DESIGN

Quantifying the relationship between worker performance and environmental conditions, or more broadly office design, is considered by some as the holy grail. Most researchers and practitioners acknowledge that there is a relationship but, as it is difficult to quantify an effect on productivity, it is often simply ignored. This approach is particularly disturbing with the current focus on reducing space and property costs. Not only do we not know how much our designs are affecting individual and business performance but we also do not know whether they are having a large negative effect on performance.

Our approach has focused on justification for additional spend on the improvement of environmental conditions and workplace design. We believe that we have created a robust methodology for quantifying performance effects. The approach is one that financial directors are more likely to accept for use in the business case for workplace improvements. We hope that it also reminds the design and construction industry of the possible dire consequence of lack of investment in good workplace design.