



**Faculty of Business and Economics
The English Language PhD Programme**

**THE IMPACT OF THE INDOOR ENVIRONMENT ON
THE PRODUCTIVITY OF CALL CENTRE
EMPLOYEES**

By

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THE TRUE
THE BEAUTIFUL
THE GOOD

The three principles for this thesis - platonic dialogues

RESEARCH POLICY

'Know what you have to do and do it'(Critchlow, 1993)

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What is a Call Centre? *A coordinated system of people, technologies and strategies that effectively integrates organisational resources and multiple channels of communication to enable customer interactions that create value for customers and the organisation* (Cleveland and Harne, 2004).

Abstract

Call centres are ubiquitous. The call centre industry is growing rapidly and permeating every segment of the 'white collar' industry and particularly the customer service sector.

While most researches evaluate and dissect the centrality of non-physical determinants to the customer and employee satisfaction, organisations perceive the built environment as an expenditure that needs to be minimised.

High attrition, turnover and absence rates are considered to be key issues and challenges not only confined to HRM but encompass the entire process of the design, construction and operation of call centres.

This study uses data from the author's thesis to explore the interrelation between indoor conditions, employee satisfaction as a mediator variable and low productivity. The findings explicitly demonstrate low level of employee satisfaction with the built environment contributing to the chronic maladies of high attrition, absence and turnover rates.

Five indices are used to represent the impact of the indoor environmental parameters (IEP) on employee well-being in general and productivity in particular and a set of recommendations are proposed as additional initiatives to offset current insufficient indoor conditions.

*The underlying assumption of this study is the **service-profit chain** concept. This approach links healthy workplace conditions to better employee satisfaction and increased productivity and consequently low rates and costs of attrition, turnover, recruitment and retention initiatives. The **service-profit chain** model can be interpreted as follows: employee satisfaction, productivity and loyalty drive customer satisfaction and loyalty and finally impacts organisational prosperity and profitability.*

Keywords

Call centres, HRM, Attrition, absence and turnover rates, Indoor environmental parameters (IEP), Productivity and Satisfaction.

1. Introduction

'Start with good people, lay out the rules, communicate with your employees, motivate them, provide adequate workplace conditions and reward them. If you do all those things effectively you can't miss.' (Lee Iacocca – Chrysler Corporation)

Globalisation refers to the interrelation between states, societies, organisations and individuals that make up the world economic system (Acs, 2000). *Globalisation*, the transformation of information and communication technologies and the collapse of institutional barriers have worked to speed up change and have raised the value of the tacit skills needed to use codified knowledge effectively. The integration of call centres in the internationalisation and globalisation trends provides an efficient and effective platform for local and multi-national exchange of information and services. Advanced information and communication technologies (ICT) facilitate the effective exploitation of human resources (HR) regardless of geographic location and consequently lead to a reduction in unit labour costs (*BA, HSBC and Norwich Union have all located their call centres in India, China and Malaysia, though their main business centres are in the UK.*), (Hill, 2005).

Multi-national companies such as Dell, transfer calls from one region to another around the globe, as an efficient technique to exploit time zone differences during peaks and lows (of call volume) (Hill, 2005).

Call centres manifest the paradigm of the 'global village' in a sense that boundaries become transparent.

It is estimated that approximately 3% of the total US labour force (more than 2,000,000 employees in 60,000 call centres) is employed in call centres (Mandelbaum, 2003; Krajewski, 2007). A similar percentage in the UK yields more than 800,000 employees (DTI, 2004).

According to Dimension Data (Occupational Health, 2004) it is approximated that the UK alone loses more than 10 million working days a year, mainly due to high attrition rates and adverse working conditions.

The indoor environment can be defined by physical features of the environment such as *lighting, colour, temperature air quality and noise* (Baizhan, 1998). According to the Institution of Engineering and Technology (2005) *nearly a third of people in the UK say they would leave their job due to the physical office environment and a further 23% have turned down a job offer due to a company's physical environment* (IET, Engineering Management, June/July edition, 2006).

It seems almost axiomatic that people perform better in a pleasant environment than in an unpleasant one (Lorsch and Abdou, 1994). Townsend (1997), in an article entitled *How to Draw out all the Talents*, states that 25% of the 'white collar' workforce enjoys their work, but the rest do not. *Productivity suffers when the employee lacks a sense of well-being. Low level productivity shows up in many ways: in a higher rate of absenteeism, arriving late and leaving early, over-long lunch breaks, careless mistakes and frustration with the environment.*

Indoor environmental parameters (IEP) are seldom a meaningful consideration in the most basic building market transactions. The fundamental problem is that those who want and are willing to pay for improved indoor conditions do not ask for this during the market transaction, thus those capable of providing improvements are not motivated to do so (Mudarri, 2006).

Research conducted in office buildings provides compelling evidence *on productivity gains (or losses) of up to 15% due to improved indoor environmental conditions* (Heschong, 2006; Wheeler and Almeida, 2006).

A complete study of the effect of IEP on *productivity* should take into consideration not only physical but also non-physical factors such as *organisational behaviour and culture, motivation socio/economic status and remuneration.*

Non-physical managerial issues in call centres such as organisational culture, emolument, etc are the subject of myriad publications. However the call centre industry lacks extensive research on the interrelation between building services such as acoustics, air-conditioning and ventilation, illumination, etc and the employee's well-being, satisfaction (as a mediator) and productivity.

Extenuation of the contribution of building services to call centre employees productivity may also be attributable to massive investment in an information and

communication technology (ICT) platform which may not always be justified (see 'Beyond The Productivity Paradox' , by Willcocks and Lester, 1999).

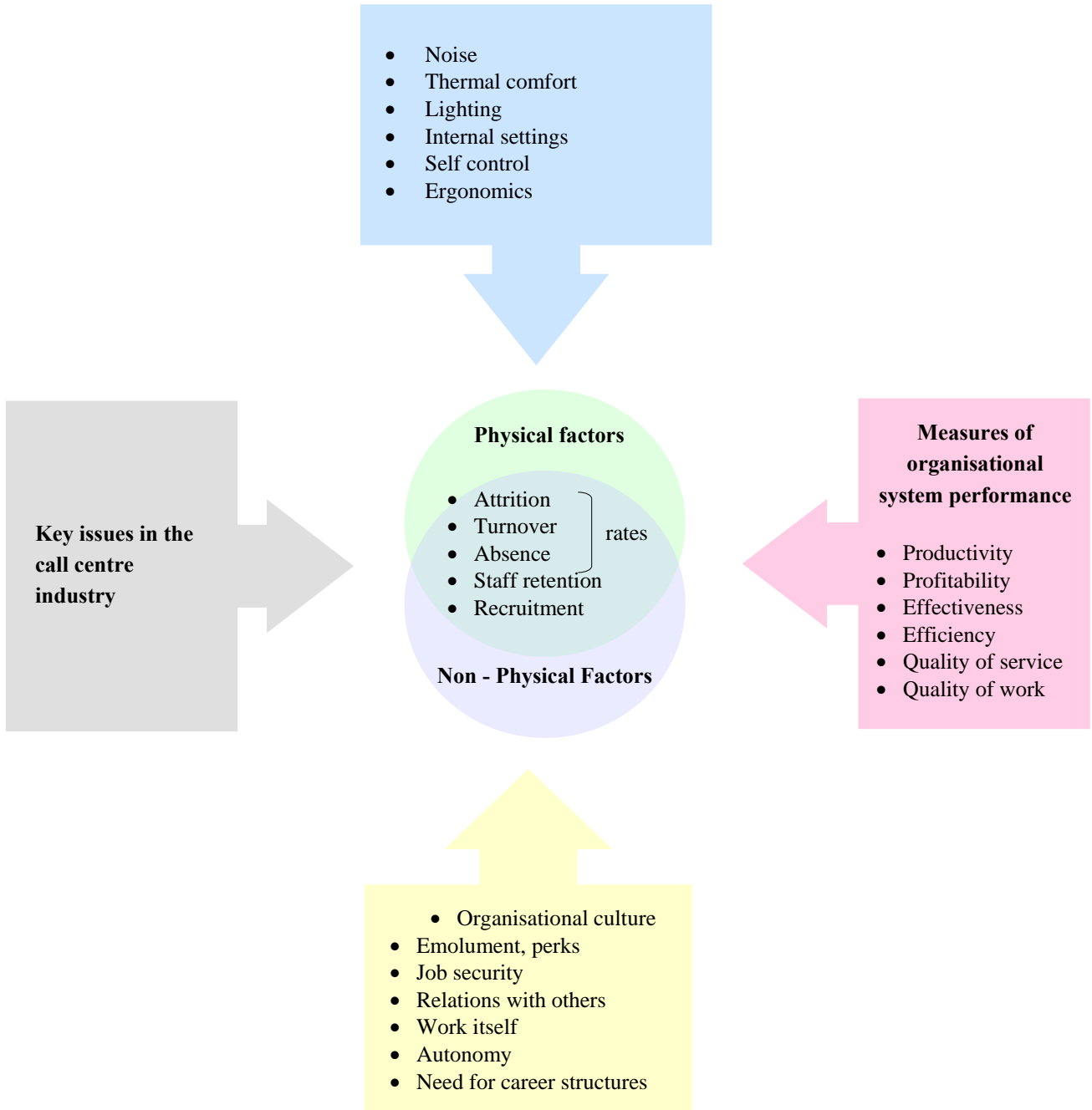


Figure 1: Key issues in the call centre industry

2. The Nature of Activity

Sometimes defined as 'electronic sweat shops', 'dark satanic mills of the 21st century' and 'human battery farms' (Fernie and Metcalf, 1998; Garson, 1988; IDS, 1999), call centres replicate a mass production attitude to customer service aiming to balance *productivity* components of *effectiveness* (the degree of accomplishment of objectives - output), *efficiency* (the degree to which the system utilized the "right" things- input) and the *level of individual and organisational performance* (Sumanth, 1984; Sink, 1985; Houlihan, 2002).

Work performed by agents and supervisors is a good paradigm for many other kinds of multi-tasking. It is routinely timed with great accuracy and a high degree of concentration (Wyon and Wargocki, 2006). *A significant determinant affecting the nature of activity is stress stemming from physical and non-physical sources.* Stress has a decisive impact on attrition, turnover and absence rates.

Working in a call centre is quite a stressful experience as agents and supervisors sit for several hours being bombarded with telephone calls and all sorts of requests some of which they cannot resolve.

A typical call centre agent deals directly with customers representing varied education and income levels, age, nationality, etc.

Work demands are multi-faceted and require patience, politeness and good verbal communications, logical thinking under time pressure and access to computer software and 'digital equipment farms'.

Call centres are often perceived as having a negative impact on employee well-being emanating from the following determinants: (i) *HRM practices*; (ii) *team leader support*; (iii) *job design*; (iv) *performance monitoring* (Holman, 2002).

Employment conditions are often highlighted as particularly stressful in comparison to other comparable sectors of 'white collar' industries. However, there is a paucity of studies that have examined the impact of non-tangible and tangible factors on well-being, satisfaction and productivity.

Bordoloi (2004) conceives call centres as repositories of knowledge – intensive operations. A competent labour force constitutes a pivotal pillar in sustaining and promoting productivity and organisational performance. HR planning and managing considerations reflect an ongoing and dynamic process rather than a stagnant one.

He asserts that emanating from *operation management studies* it is a *flow of agents through a prescribed recruitment and promotion scheme which differentiate call centres*. The call centre industry is divided into two groups of operation mode: *inbound and outbound*. In the inbound mode, the customer usually initiates a phone call and the agent provides the requested information, service, technical help desk, etc. In the outbound mode, the agent initiates the phone call with a broad range of objectives, commencing with marketing, selling, surveying, etc. Inbound call centres account for 80% of the total market share. Increased regulation and a negative customer attitude of outbound activity means that, this form of customer contact or 'voice to voice' interaction *is constantly under pressure*.

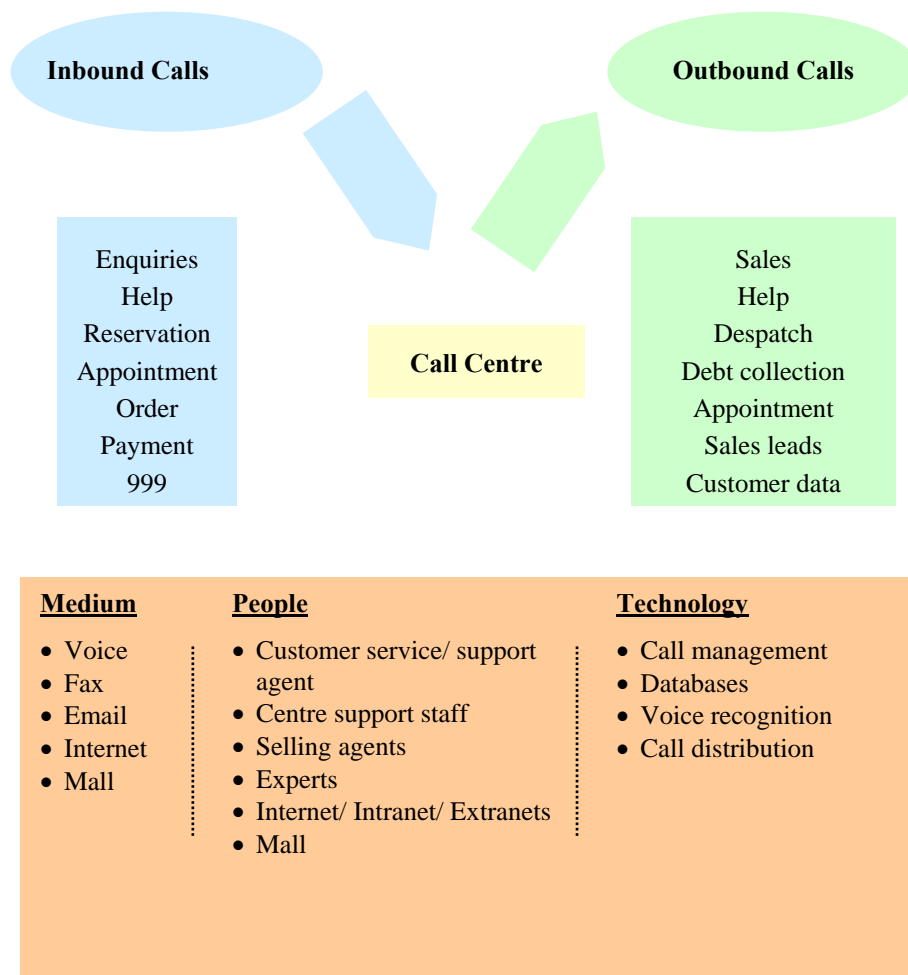


Figure 2: Call centre systems mode (source: Armistead et al, 2002)

3. Labour Force Break-down, HRM and Shift Policy

HR considerations in call centres permeate the majority of managerial issues and constitute the following key challenges:

(i) retention of staff; (ii) recruitment; (iii) absence rate; (iv) turnover rate; (v) attrition rate; (vi) outsourcing; (vii) need for career structures.

Armistead et al (2002) posits that day-to-day HR activities embrace the following areas: *(i) creating supportive work teams; (ii) coaching teams; (iii) providing leadership; (iv) motivating.*

Retention of staff poses a major challenge, especially in the first three months of employment to ensure the ROI. According to the last IDS (2006/2007) survey, more than 30% of call centre operators encountered difficulties related to staff retention. Low image of the call centre industry constitutes a key factor in the recruitment of staff. Low benefits and high attrition rates discourage a competent workforce and create imbalances in the customer/employee satisfaction equation. Absence rates in call centres are considerably higher compared to other 'white collar' sectors. On average an absenteeism rate of 8% or more than 10 sickness absences per year represents a significant loss of revenues and poor productivity.

Dean (2002) claims that the break down of the labour force in the call centre industry in terms of competences is heterogeneous and depends on traits such as customer segment, level of wages and inbound or outbound facilities.

According to Brookes (1997) and IDS (2006/2007) a 'typical' agent is a female aged between 21-29 years of age, undergraduate, travelling by car from a dwelling in a radius of up to 10km. Data supplied by the UK Call Centres Association (2001) indicates that 10% of employees are temporarily employed through agencies, or are outsourced. In some sectors engaged with special assigned tasks the figure could rise to 80%.

These findings correspond with the IDS (2006/2007) survey. Additional data provided by the survey indicates *that 95% of the UK call centres employ part-time staff and the proportion of part-timers ranges from 0% to 83% with an average of 26%.*

Employees usually work staggered shifts to provide an ongoing service. There is, however, a misconception regarding the hours of operation. A survey by Brookes

(1997) discloses that only 19% of call centres are open round the clock, more than 60% employ less than 50 employees and only 4% employ more than 500 employees. The last Pay and Conditions in Call Centres 2006/2007 Survey (IDS, 2006), indicates a significant evolvement in call centre structure with an average of 636 employees and the median number being 344.

Call centre retention policy embraces four categories (Communication Worker Union, 2004, www.cwu.org):

- a. Remuneration (improved base salary, perks, etc);
- b. Recruitment (better training, career development policy);
- c. Work environment (better facilities, flexible shifts and working hours, reduced work-life imbalance);
- d. An advanced managerial policy (introducing transparency, communication, feedback).

With the growing process of globalisation and integration, call centres tend to extend and modify their shift-pattern. Pay and Conditions in Call Centres (IDS, 2006/2007) finds shift-patterns to be a major predicament in recruiting and retaining call centre agents.

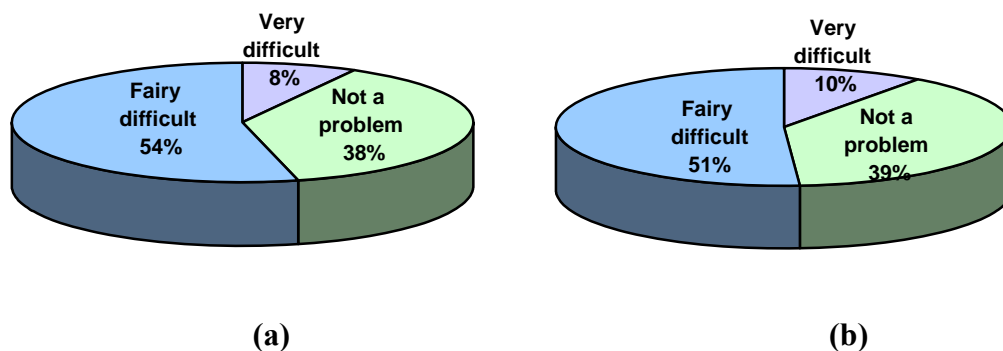


Figure 3: Proportion of organisations reporting recruitment difficulties (a) and retention difficulties (b) (source: IDS, 2006/2007)

4. Attrition, Turnover and Absence Rates

The annual attrition rates (generally defined as the number of agents who leave within a 12-month period of time) is perceived to be a major concern for the call centre

service industry. IDS (2003) *Income Data Services Pay and Conditions in Call Centres* finds staff attrition rates of 25.1% in the UK, considered highest in the retail and transport sectors and lowest in the public sectors. Heskett et al (1994) posits that the real cost of high attrition and turnover rates are the loss of *productivity and decreased customer satisfaction*.

Cleveland and Harne (2004) define turnover as a significant key performance indicator (KPI) impinging call quality, number of errors, average handling time (AHT), overall organisational performance and productivity.

The Chartered Institution of Personnel and Development (UK), estimates that the total costs incurred due to turnover are \$7,500 per agent and \$ 10,000 for managerial staff. The total costs for the British call centre industry due to high attrition and turnover rates are over \$2 billion per annum (Blue Sky, 2001, no further details).

The turnover rates in the United States are substantially higher. Bordoloi (2004) reports that for the year 2000 the turnover rate was 50%! The length of tenure for call centre agents was 38% for 12-24 months and 30% for 6-12 months.

He further states that on average the recruitment cost of a new agent is \$6,000 and each call costs the owner about \$10.

The three reasons for high turnover are (Bordoloi, 2004):

- a. *Poor wages and perks;*
- b. *Lack of career prospects;*
- c. *Attrition – burnout due to the intensity of physical and non-physical working conditions.*

According to data made available by the DTI (2004) pay is identified by 46% of the respondents as a key factor, with the intensity of work seen as a cause by 42% of the organisations.

Bordoloi (2004) claims that most *call centre employees perceive their current occupation as temporary - a job rather than career*.

According to the DTI (2004) *a newly competent agent's salary (in a 100-agents call centre) is \$26,000*. The average training period of an agent is 3-4 weeks. An additional period of several weeks or even months will elapse until the agent will be fully effective. A 12-month agent's position period will result in an expenditure of approximately \$2,166 training costs with an effective employment period of 11

months – a real employment factor of 0.916. However when turnover is extended to 18 months, training costs will remain the same but the effective employment period will be 17 months- an employment factor of 0.944. This will have a direct impact on organisational performance and profitability.

The actual position period varies sharply between 12 months to 51 months. According to ContactBabel the mean average is 39 months (DTI, 2004).

Details provided by Israeli call centre supervisors denote length of tenure as 8 to 36 months. According to the author's findings the attrition rate is 31.4%.

The most common initiatives introduced by HRM departments to tackle high turnover and attrition rates (IDS, 2006) are: (i) *return-to-work interviews*; (ii) *bonus linked to attendance*; (iii) *occupational health programmes*; (iv) *training for line managers*; (v) *absence management programmes*; (vi) *employee engagement surveys*; (vii) *monitoring and attendance reviews*.

Figure 4 depicts the average staff turnover by sector indicating a traditional tendency of gravitating from so-called *stable positions* to *temporary positions* (UK, data).

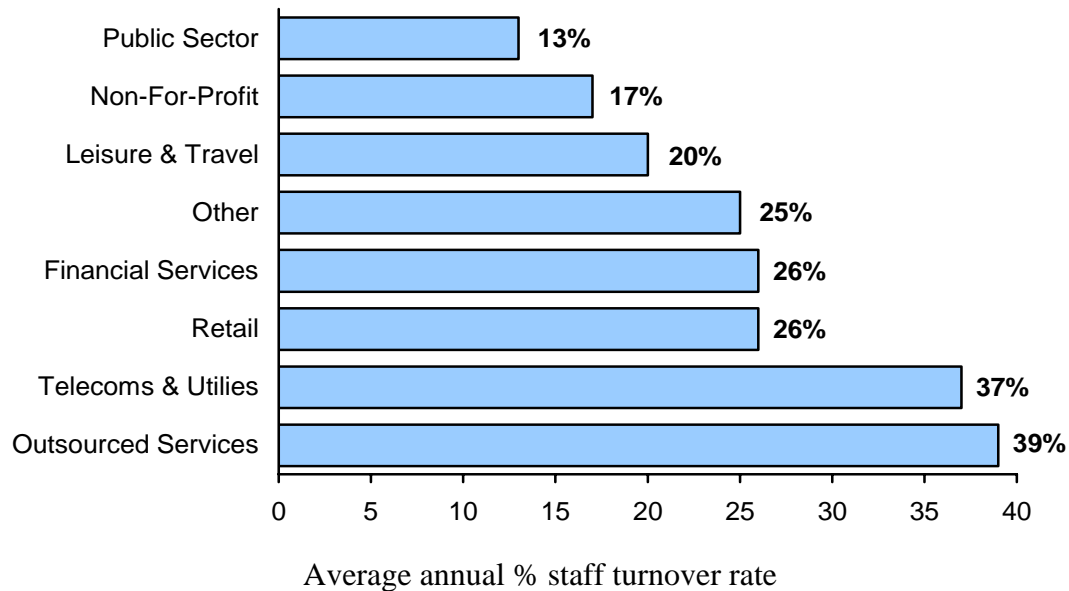


Figure 4: Average staff turnover by sector

Surprisingly, only a few of studies have been conducted to investigate the impact of indoor environmental parameters (IEP) on call centre employee performance and gain or loss of productivity and consequently high turnover and attrition rates.

5. Productivity Measurement

Access to organisations is frequently fraught with difficulties, as incumbents are disinclined to cooperate and expose employees to questions that may provoke potential organisational unrest.

Economic benefits such as savings in the initial outlay, the operating costs of building facilities, a gain in *productivity* and enhanced profitability are typical incentives for incumbents to cooperate and actively take part in the survey process.

Self-assessment of productivity (sometimes defined as perceived productivity or self-reported productivity) is a subjective and indirect measure. Raw (1993) considers *self-assessed productivity as effective as actual and objective productivity measurement*.

Roethlisberger and Dickson's (1939) study of the *Hawthorn Works phenomenon* provides corroborative evidence that *perceived productivity* does reflect actual data. They find a strong association ($r=0.99$) between actual and perceived output.

Leaman and Bordass (1997, 2006) advocate *perceived productivity* measurement and argue that a single question is common to all respondents and could be applied to different types of occupations and buildings. The main disadvantage is the need of occupants to assess their own output without a benchmark, the susceptibility of employees to non-environmental factors (stress, personal worries, etc.) and the nagging doubt that *perceived productivity* does not reflect actual *productivity*.

The *perceived/self-assessed productivity* approach is extensively used in the UK in 'white collar' industries where output is predominantly intangible.

6. The Impact of Indoor Environmental Parameters (IEP) on the Performance and Productivity of Call Centre Employees

Comfort has been defined as 'the condition of mind that expresses satisfaction with the environment' (ASHRAE, 2004)

Studies in the United States reveal that improving IEP could reduce absenteeism, health costs and increase employee performance. These reductions total an estimated productivity gain of \$30 billion to \$150 billion annually (Fisk and Rosenfeld, 1997). They approximate that annual savings and productivity gains from improved indoor conditions could be \$6 - \$9 billion from reduced respiratory diseases, \$10 - \$20 billion from reduced sick building syndrome (SBS) and \$12 - \$125 billion for improved worker performance that is unrelated to health.

Mudarri (2006) suggests that potential improvement in the built environment might be between 18 - 47 times the costs of those improvements. Dorgan and Associates (1993) calculate that with an initial investment of \$88.6 billion in the built environment, the USA economy can achieve productivity gains worth \$55 billion with a pay back of 1.6 years and an annual cost of \$4.8 billion to maintain the improvements.

Heschong (2006) conducted a multi-faceted research in two call centres and claims that potential improvement in *performance and productivity due to better IEP could come to \$1,270/m² per annum*.

Well-being reflects a healthy mind and body (figure 6) overall contentment with the surroundings, some degree of control of the surroundings, thermal comfort, air quality, light and acoustics. *Productivity* depends on satisfaction, self-esteem, technical competency, organisational behaviour, a responsive environment and a good sense of well-being (Croome, 1997; Baizhan, 1998).

Figure 5 delineates the broader picture of tangible and intangible factors impacting productivity in 'white collar' industries.

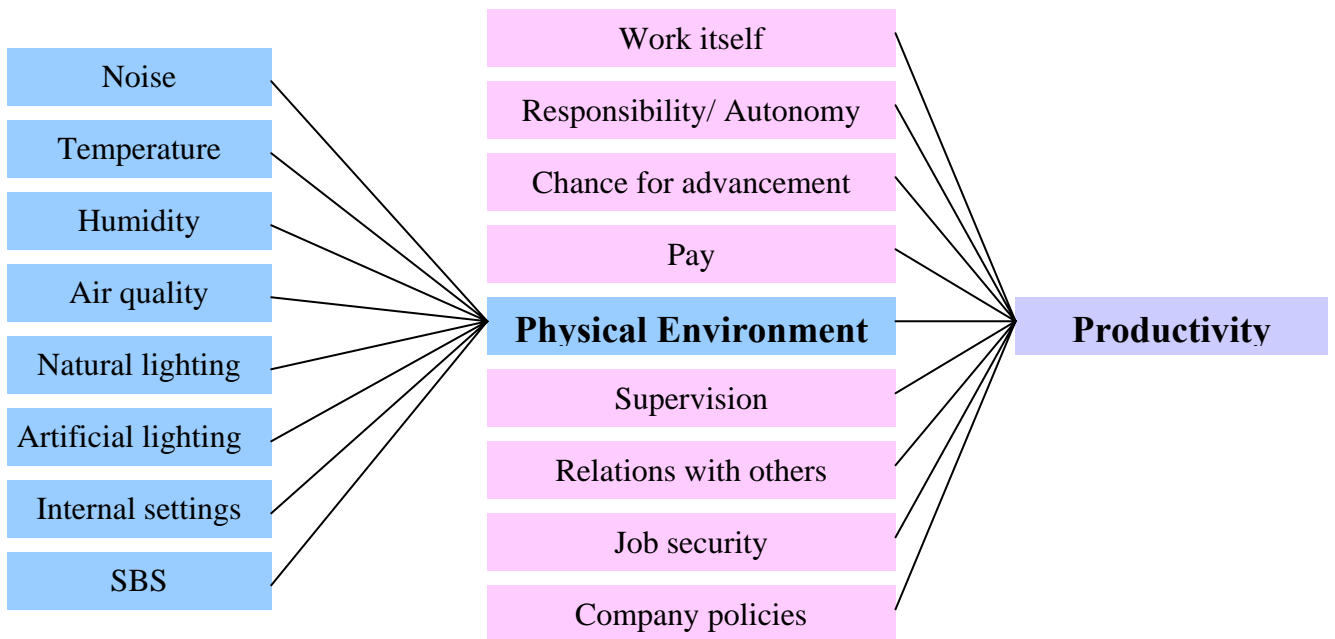


Figure 5: Correlation between the physical and non-physical parameters and productivity

Warr (1998b) proposes three indicators to evaluate well-being:

- a. *Pleasure to displeasure;*
- b. *Comfort to anxiety;*
- c. *Enthusiasm to depression.*

Croome (2006) claims that well-being is only one aspect of mental health; other aspects include personal feelings about one's competence, aspirations and degree of personal control.

Well-being is important for good work production. Task performance is best when mind and body are at an optimum stimulation level with a high degree of satisfaction. Motivation stems from satisfaction and sums up physical and non-physical factors that have a low or high magnitude and a positive and negative direction.

Heerwagen (1998) argues that performance (P) depends on:

- i. *Motivation;*
- ii. *Ability;*
- iii. *Opportunity.*

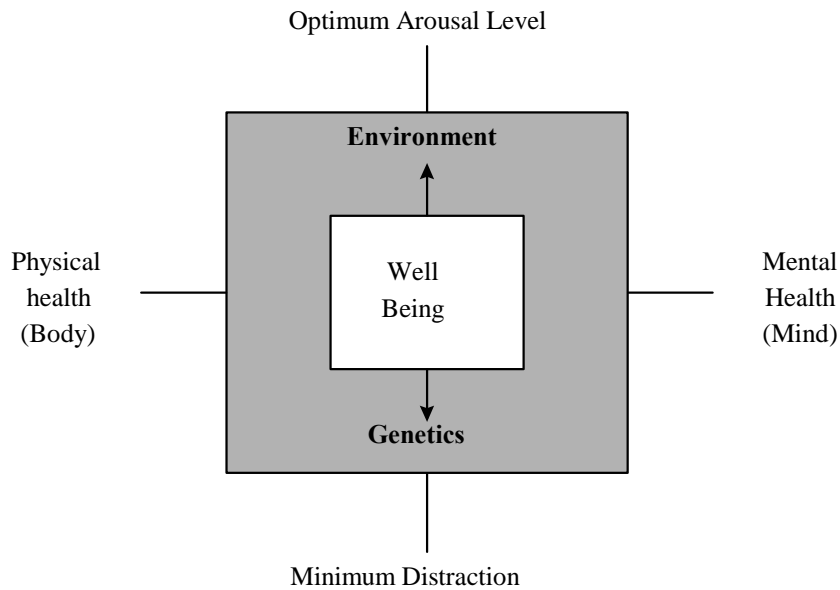


Figure 6: Correlation between well-being, mental and physical factors
(Source: Croome, 1997)

Baizhan (1998) proposed the following regression equation for evaluating an unsatisfactory indoor environment, which comprises physical and non-physical parameters:

$$En = -0.7211 + 0.5997 * Th + 0.4082 * SBS + 0.3222 * CS \quad (r = 0.6546, F = 36.99 > F_{\alpha = 0.01} [3, 152] = 3.92)$$

Interpretation: the equation links suffer from IEP to thermal problems, density and SBS (sick building syndrome).

Where En= an overall unsatisfactory indoor environment, Th=suffering from thermal conditions, SBS=suffering from SBS (sick building syndrome), CS=crowded working space, F=statistical F test, r=correlation coefficient.

7. The Research Methodology

The methodology was developed to realise the main goals discussed in previous sections encompassed the following areas:

7.1 Indirect (Subjective) Data Collection and Dissection

- i. Previous and current research that links workplace design to satisfaction and productivity in call centres at the individual level;*
- ii. Previous and current research regarding the impact of indoor environmental parameters (IEP) on employee satisfaction, performance and productivity in 'white collar' industries (with emphasis on 'open space' facilities).*

7.2 Direct (Objective) Data Collection and Processing

These consisted of the following stages:

- i. Interviews with employees, facilities managers (FMs) and managerial staff;*
- ii. Surveying call centre and 'white' collar employees using a questionnaire particularly developed for this purpose (N=228; N=106);*
- iii. In-situ measurements of the indoor environmental parameters;*
- iv. Statistical analysis with cross-correlation of gender, age, length of tenure, indoor environmental parameters (IEP), satisfaction, productivity and performance;*
- v. Statistical cross-correlation of call centre and 'white collar' employee preferences in indoor workplace conditions.*

7.3 Aggregation of Independent Variables

- i. To statistically analyse data pertaining to the indoor environment the ten measured indoor properties (see appendix i in the questionnaire) have been gathered into four combined groups of independent variables representing: indoor environmental conditions; thermal comfort; visual conditions (two variables) and acoustic conditions;*
- ii. An additional (fifth) independent variable was added to represent the space ergonomic setup - the ability to control the indoor environment;*
- iii. For similar reasons, the ten responses related to satisfaction with indoor conditions have been gathered into four combined groups of mediating variables representing satisfaction with indoor environmental conditions;*
- iv. Aggregating the ten measured properties of the indoor environmental parameters into five groups (variables) and the ten satisfaction parameters into four groups,*

was an effective way to extract statistical data from the questionnaire without diminishing the statistical significance.

7.4 Developing the Methodology of the Research Model

The research model postulates that independent variables are lined to the dependent (single) variable via mediating variables.

(a) Independent Variables – Building Indoor Properties (Objective Properties):

Independent building variables are associated with the indoor environment and consist of the following indices: *temperature, humidity, internal air quality, day lighting, artificial lighting, noise ergonomics (space allocation-internal settings) and overall sensation (impression) of the internal design (the indoor environment)*. These variables were measured in physical dimensions (except for the overall sensation which was subjectively assessed at the author's discretion) of the internal design. For the sake of simplifying the statistical processing of the data, the above mentioned indoor parameters were aggregated into five variables called **SENSATION INDICES** each at the type of ordinal series as follows:

- i. **TSI** (Thermal Sensation Index) ranging from -3 to+3 (table 1, appendix II);
- ii. **ASI** (Acoustic Sensation Index) ranging from 0 to +2 (ditto);
- iii. **AVSI** (Artificial Visual Sensation Index) ranging from -1 to +1 (ditto);
- iv. **NVSI** (Natural Visual Sensation Index) ranging from -1 to +1 (ditto);
- v. **OI** (Overall Sensation Index) ranging from -1 to +2 (ditto).

Note: For the purpose of overall statistical analysis **AVSI** and **NVSI** were combined into one sensation index – visual conditions or lighting. **OI** encompassed also internal settings and ergonomics.

(b) Mediating Variables – Satisfaction with the Indoor Environment (Subjective Variables):

Mediating variables represent satisfaction with the indoor conditions and links the *independent variables* a (see above) to the dependent variable *productivity*.

Mediating variables encompass five groups:

- i. Satisfaction with thermal conditions (thermal comfort) was obtained as a combination of (averaging) sub-questions 1-4 question 3 in appendix I;

- ii. Satisfaction with lighting was obtained as a combination of (averaging) sub-questions 5-6 question 3 in appendix I;
- iii. Satisfaction with noise (acoustics) was obtained as a combination of (averaging) sub- questions 7-8 question 3 in appendix I;
- iv. Satisfaction with ergonomics (space allocation) was obtained as a combination of (averaging) from sub-questions 9-10 question 3 in appendix I;
- v. Satisfaction with the overall interior design – overall impression was obtained as a combination of (averaging) sub- questions 1 – 10 question3 in appendix I.

(c) Dependent Variable – Productivity:

The dependent variable - *self-assessed productivity/perceived productivity* (also self-reported productivity) is expressed in percentages as continuous values (0%, 10%, 20% etc) and is based on question 5 (see questionnaire – Appendix I).

Note: The dependent variable (self-assessed productivity/self-reported productivity) *does not represent dichotomy* (for example 0% or 100%). The research model and previous experience with productivity assume a continuous range of values expressed above (see also list of references – Leaman and Bordass, 1997, *Productivity in Buildings: The killer Variable*). This was the underlying factor in analysing the questionnaires using the regression approach.

7.5 Processing the Data

- (a) The first main hypothesis dissects the linkage between independent building properties and the mediating variables – *satisfaction*;
- (b) The second main hypothesis dissects the linkage between mediating variables and the dependent variable – *productivity*.

8. Stepwise Regression for Satisfaction and Self-Assessed Productivity as a Dependent Variable

Table 1 summarises the model in general using stepwise regression in blocks. The main model describes three variables. The dependent variable is an assessment of self-reported productivity as a percentage; the mediating variable is satisfaction with the environmental conditions while the independent variable is the type of organisation studied.

Due to the complexity of the model, the predictive ability of the dependent variable is explored in two blocks. The first block includes the mediating variable (satisfaction) and the second block includes the independent variable (sensation).

Category	Block 1 (Satisfaction)			Block 2 (Sensation)		
	B	Beta	t	B	Beta	t
(Constant)	26.727		4.931***	2.831		.505
Satisfaction with indoor conditions (SIC)	-1.962	-.101	-1.281	-.824	-.043	-.612
Satisfaction with lighting(SL)	2.043	.144	1.991	.978	.069	1.080
Satisfaction with thermal comfort(STC)	2.370	.147	1.772	.990	.061	.839
Satisfaction with noise level(SN)	2.864	.166	2.227*	2.824	.163	2.513*
ASI				16.066	.481	7.982*
	F[4,202]=5.138** R ² =0.092			F[5,201]=18.130*** R ² =0.311		

Excluded Variables: TSI, AVSI, NVSI, OI

Table 1: Stepwise regression in blocks for predicting self-assessed productivity using satisfaction with environmental conditions and sensation indices

The findings indicate the statistically distinct predictive ability of the satisfaction variables (with illuminance, noise, ergonomic and thermal conditions); [F (4,202) =5.138; p<0.01; R²=0.092]. *Satisfaction with the acoustic conditions is found to have the greatest contribution.* The other mediating variables (such as satisfaction with illuminance, thermal comfort and ergonomics – space allocation) have a further but lesser contribution.

Thereafter all the predictors (sensation indices) were included – the natural visual sensation index, the artificial visual sensation index, the thermal sensation index, the acoustic sensation index and the overall sensation index that contribute to the mediation of the satisfaction variables when predicting self-assessed productivity. *Of all the predictors, the acoustic sensation index is found to be the sole distinct predictor through which productivity can be assessed.*

The acoustic sensation index (ASI) is the best and most appropriate factor considering its contribution to predicting productivity. Satisfaction with the thermal comfort takes second place.

Table 1. leads to the following regression (empiric) equation:

$$\text{Self-assessed productivity} = 2.831 + 16.066*(-\text{ASI}) + 2.824*\text{SN} + 0.990*\text{STC} + 0.978*\text{SL} - 0.824*\text{SIC}$$

Note: Values of ASI imply negative impacts; 0= neutral, +1= slightly distracting and +2= distracting

Values for self-assessed productivity can be taken from table 1 in appendix II (for ASI) and for satisfaction from section 5.7 (in the thesis).

The range of self-assessed productivity benchmarks is:

With best IEP conditions: 22.7 (ASI=0, satisfaction in all categories=5; very good)

With worst IEP conditions: -25.3 (ASI=2; satisfaction in all categories=1; very bad)

The equation above was derived from a multiple stepwise regression of all variables, and presents the productivity as a function of both independent variables (actually, only ASI) and mediating variables (SIC, SL, STC, SN).

To complete the model, it is necessary to express the variables of satisfaction with *lighting, noise, thermal comfort ergonomics and overall interior design* (the mediating variables) as a function of the sensation (building) parameters.

To this end, the *multiple stepwise linear regression technique* was applied, with the dependent variables being sensation indices (representing building attributes): **TSI, NVSI, AVSI and ASI.**

The following results for four out of the five variables are:

- i. Satisfaction with *lighting* is predicted using ASI and NVSI variables (all other variables were found not significant):

$$\text{SL} = 2.395 + 0.305*\text{NVSI} + 0.147*\text{ASI}$$

Note: It is important to mention that the regression above explains 8% of the influence on satisfaction with *lighting*, namely the remaining 92% are affected by other attributes, not related to the indoor environment.

ii. Satisfaction with *noise* is predicted using the ASI and AVSI attributes (that explain only 10% of the changes occurring therein):

$$SN=2.592-0.321*ASI+0.362*AVSI$$

iii. Satisfaction with *indoor* conditions (internal settings – space allocation-ergonomics) is predicted using the NVSI attribute alone (explains only 2% of the changes):

$$SIC=3.229+0.160*NVSI$$

iv. Satisfaction with *overall interior conditions* is predicted by TSI and NVSI that explain only 3% of the changes:

$$SOI=3.077+0.138*NVSI-0.077*TSI$$

Note: The statistical analysis shows that the certainty of predicted satisfaction with *thermal conditions* is low compared to other mediating variables. There could be several reasons for this poor prediction, one of them is the fact that thermal conditions while completing the questionnaires were comfortable and ignored by the majority of respondents. Therefore, this relation should be taken with reservation, and further research should be taken to improve its validity.

9. A Comparison between the Levels of Satisfaction with Indoor Environmental Parameters in Call Centres and Other 'White Collar' Segments

The hypothesis of inferior indoor conditions in *call centres was central to this study*. Some of the facilities visited by the author suffer from dismal conditions. To invigorate and objectively explore this paradigm, a comparison between the levels of satisfaction with indoor environmental parameters of the occupants in call centres and other 'white collar' facilities was conducted.

Three distinct differences were found when the disparities in the scores for satisfaction between call company centres and other 'white collar' companies were examined: with regard to satisfaction with the air quality ($t(297) = -1.836$; $p=0.067$); with respect to satisfaction with noise ($t = -10.694$; $p<0.001$), (297 and as regards satisfaction with the ergonomic conditions ($t(297) = 3.319$; $p<0.01$). Similarly, distinct differences were found in general satisfaction between the two types of organisation, wherein other 'white collar' employees (R&D, hi-tech, insurance, etc) *are more satisfied with the environmental conditions than are employees at call*

centres. Satisfaction with the level of noise amongst call centre employees is significantly lower (2.64) than that measured amongst hi-tech employees (4.16).

Employee satisfaction with the illuminance finds no significant statistical differences and employees of both types of organisation reported moderate satisfaction.

Category	Other 'white collar' companies n=106		Call centres n=228		T(297)
	SD	Mean	SD	Mean	
Air	.84	3.44	.77	3.24	-1.836;p<0.067
Illuminance	1.01	3.36	.940	3.33	-0.186
Noise	1.07	4.16	1.05	2.64	-10.694***
Ergonomic	1.06	3.88	0.86	3.59	3.973***
General	0.74	3.53	0.65	3.23	-3.319**

Table 2: Variance in the levels of occupants' satisfaction with the indoor conditions in call centres and other 'white collar' segments

10. Findings

- a. An extremely high rate (31.4%) of the annual labour force turnover confirms a key research hypothesis. This figure is markedly higher than the average turnover rate in the UK of 25.1% and alludes to inferior physical and non-physical conditions compared to other segments of 'white collar' industries;
- b. Interviews and discussions with call centre facilities managers and managerial staff reveal disquieting data: The vast majority of decision makers are unaware of the linkage between loyal customers and employees, employee retention policy, high turnover and attrition rates, productivity and better physical indoor conditions;
- c. The pricing of facilities and fit-out equipment is a major topic and consideration in the process of procuring premises. It negatively impacts the crucial stage of finishes and fit-out;
- d. Factors, such as the life cycle cost, added value and the occupants' well- being are scarcely considered;
- e. Overall level of employees' satisfaction in other 'white collar' segments is noticeably higher compared with the call centre industry;

- f. Statistical analysis provides an interesting correlation between the ability to predict satisfaction (as a mediator variable) and indoor conditions. 10% of overall employees' satisfaction is attributed to indoor environmental parameters. The rest may be attributed to non-physical determinants, such as organisational behaviour and culture, remuneration, etc.

11. Conclusions

The workplace is the realm of the employee. Its physical and non-physical boundaries stipulate the degree of privacy, interaction and, on the macro scale a sense of well-being. In the long run poor visual conditions, lack of daylight, an unacceptable level of noise and inferior thermal comfort would result in the acceleration of high turnover and attrition rates (and probably health conditions!).

12. Recommendations

The findings and conclusion of the study lead to a series of recommendations at two complementary platforms – *the non-physical and the physical*.

Implementation requires a rigorous study based on techno-economical trade-offs between different options.

Non-Physical recommendations

- i. It is recommended undertaking post-occupancy evaluation one year after completion and operation of newly constructed or refurbished call centres. A second POE is advisable three years later, following the implementations of the first set of recommendations. A POE is also recommended whenever a major construction works is planned in existing call centres;
- ii. Circulating a multi-disciplinary questionnaire once a year among *all employees* is suggested to assess *self-assessed (perceived) productivity*. The questionnaire should contain the main determinants influencing the employees' realm, i.e.: remuneration, career prospects, workplace conditions – indoor environmental parameters (IEP), etc – with respect to *self-assessed productivity*;

- iii. It is advisable for organisations *operating more than one call centre* to benchmark their employees' productivity and performance and premises and to establish a list of organisational benchmarks;
- iv. It is advisable for organisations *operating more than one call centre and employing more than 1,000 employees* to adopt a systematic enterprise risk management (ERM).ERM during the construction phase and ERM during the operating phase are *key factors to control cost, cope with unexpected events and remain competitive and profitable*;
- v. Briefing either client or project brief is a crucial step in providing adequate indoor conditions. It is the responsibility of the management. The brief should be prepared according the *unique features of the designated call centre* to reduce additional expenses and construction time while concurrently elevating quality.

Physical recommendations

Present codes of practice and technical guidelines treat call centres as 'open space' offices.

The high level of unsatisfactory evidence provided by respondents (for example 25% of all employees found that their acoustical environment is distracting and ranked their working conditions as poor) emphasizes the need for the design community to refresh its overall design approach.

This can be achieved by:

- a. *Adding additional paragraphs to existing national or international codes (such as the EN, CIE, etc.) covering separately the subject of call centres, or*
- b. *Editing special technical guidelines either by national call centre associations or by special assigned professionals and academics taskforces (on an ad hoc basis).*

There is an urgent need for architects, town planners and building services engineers to join forces to close the growing gap between sophistication of management especially regarding human resource issues, the digital platform and the physical properties of the indoor and outdoor environment.

13. Summary

In the modern unabated race for maximizing profitability, revenue, productivity and customer satisfaction, call centres constitute an indispensable link between the organisation and the customer. Globalisation, information and communication technology have facilitated the proliferation of call centres throughout the entire globe. However, despite innovative HRM policies embedded, the call centre industry still faces substantial challenges in term of *high attrition, turnover and absence rates and low productivity*.

Usually call centre employees spend between eight to twelve hours at the workplace which feature *oppressive indoor conditions*. The erroneous notion that call centres should be designed as 'open space' offices concurrently with the tendency to diminish the importance of physical indoor conditions such as acoustics, thermal comfort, daylight and ergonomic consideration exacerbate the maladies of the industry. Physical aspects contribute only 10% to productivity gains. However, an enhanced indoor environment is imperative for satisfied employees (who directly and indirectly bias their approach towards *sometimes patience-less customers...*) and overall organisational performance. To reap potential benefits the stakeholders should revitalize design and construction approaches.

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Appendix I

QUESTIONNAIRE FOR AN ENVIRONMENTAL ANALYSIS OF CALL CENTRES EMPLOYEES

(This page should be completed by shift manager only)

1. Determining the Parameters for Assessing Productivity, Output and Performance

What are the main parameters you would choose to assess your staff performance?

1. No. of questionnaires _____% of total assessment score
2. No. of mistakes in the questionnaires _____% of total assessment score
3. No. of people refusing to be interviewed _____% of total assessment score
4. Other (Detail) _____% of total assessment score

Please Answer all the Questions According to Your Personal Feelings. It Should Take 10-15 Minutes.

2. Personal Details

Age	
-----	--

Gender	F	M
--------	---	---

Years of work experience	
--------------------------	--

3. Level of Satisfaction with the Internal Environmental Conditions

Please assess the following factors; please mark only one square most suitable to you.

No.	Brief description	Very bad	Bad	Acceptable	Good	Very good
01	Room temperature					
02	Air flow (stagnant air, breezes etc)					
03	Room humidity					
04	Level of air quality (fresh air, stale air)					
05	Quality of lighting – artificial lighting					
06	Availability of daylight					
07	Level of noise – speech etc					
08	Level of background noise					
09	Internal settings (colours, furnishings)					
10	Size of space allocated for your workplace					

4. Level of Satisfaction with the Ability to Control Internal Environmental conditions

Please assess how important/not important is ability to self-control your workplace environment; please mark only one square most suitable to you.

6. Assess, as a Percentage, the Degree to Which Improvement in IEP (indoor environmental parameters) would Contribute to Your Productivity and Performance at Work.

[.....]	[.....]	[.....]	[.....]	[.....]	[.....]	[.....]
0%	10%	20%	30%	40%	50%	Above 50%

7. Assess, as a Percentage, How do You Think Your Productivity and Performance at Your Workplace should be Measured

7.1 There are two approaches to assessment – the direct approach, that refers to the quantitative measurement of the employees'/ workers' output or the indirect qualitative approach. In the direct approach the level of productivity or output are measured, for example, according to the number of calls per hour with which you deal, AHT (average handle time), blockage (% of calls receiving busy signal) etc.

[...] %

7.2 In the indirect approach, the level of productivity or output are measured indirectly, for example, according to your level of satisfaction, motivation, speed and answering, how long you spend by your desk, number of days of sick leave

etc. [...] %

Total 100%

8. What Do You Think are the Main Parameters for Assessing Your Productivity and Performance at Work?

.....

.....

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.....

.....
.....

Appendix II

Index	Range	Ranks
The Thermal Sensation Index (TSI) based on Fanger's theory (see section 3.5)	[-3,3]	-3 <i>cold</i> -2 <i>cool</i> -1 <i>slightly cool</i> 0 <i>neutral</i> + 1 <i>slightly warm</i> + 2 <i>warm</i> + 3 <i>hot</i>
The Acoustic Sensation Index (ASI)	[0,2]	0 <i>neutral</i> + 1 <i>slightly distracting</i> + 2 <i>distracting.</i>
The Artificial Visual Sensation Index (AVSI)	[-1,1]	-1 <i>low level</i> 0 <i>neutral</i> +1 <i>high level</i>
Visual variables & Natural Visual Sensation Index (NVSI)	[-1,1]	-1 <i>gloomy – no daylight</i> 0 <i>neutral</i> +1 <i>pleasant – daylight</i>
Overall Sensation Index (OI)	[-1,2]	-1 (<i>poor/congested</i>) 0 (<i>acceptable</i>) + 1 (<i>good/comfortable</i>) + 2 (<i>very good/ ample of space</i>).

Table 1: Compilation of sensation indices