AN ANALYSIS OF ENVIRONMENTAL FACTORS IN OPEN OFFICE LAYOUTS

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DECLARATION

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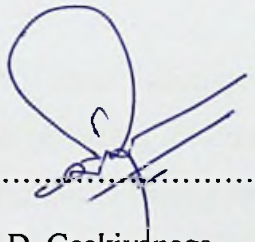

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Date

The above candidate has carried out research for the Masters Dissertation under my supervision.

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ABSTRACT

'Cellular office layouts' and 'open office layouts' are the two main office designing techniques available for a Facility Manager. The latter is the widely used technique out of the two due to the reasons such as efficient space utilization, cost effectiveness, easiness in altering the layouts etc.. Although, both the techniques have its advantages and disadvantages, it is observed that lot of grievances exist among the users of "open office layouts".

The employee productivity and Job satisfaction level are found to be inter-related. Hence the factors affecting the job satisfaction level of an employee is vital for organizational management. Satisfaction level about the work place is identified as one of the factors affecting job satisfaction level of an employee.

The literature available about working environment and productivity, discusses about the attributes which affect **O**verall **E**nvironmental **S**atisfaction level (Satisfaction level about ones work place) of an employee occupying a workplace. Out of them, the researcher identified 21 attributes as the base of his study and developed a questionnaire to gather information about the occupant's Overall Environmental Satisfaction level in relation to the identified attributes. Survey done among the 46 executives in two offices, implies that the 21 attributes identified, have a direct impact upon the Overall Environmental Satisfaction level of an occupant. Hence inclusion of said 21 attributes, into layout designs is very vital in providing an efficient and productive working environment.

Further, a detailed analysis about customer requirements and their interdependencies, prior to design a layout, is important, since success of the proposed layout will depend upon inclusion of them.

User awareness about the functionality and design considerations (or assumptions) of the layout is also important in maintaining the office layout as intended.

Finally the office layouts are to be checked routinely, for their intended performance levels after handing over.

Key words: *Open office layouts, physical environment and productivity, Office environment, Environmental satisfaction in open plan environments.*

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ABBREVIATIONS

AC	.. .. ..	Air Condition
A/L	.. .. ..	Advanced Level
ANOVA	.. .. ..	Analysis of Variance
Asst. Arc.	.. .. ..	Asset Arcade
Coeff.	.. .. ..	Coefficient
CTO	.. .. ..	Central Telegraph Office
Env	.. .. ..	Environment
FM	.. .. ..	Facility Management
GFL	.. .. ..	Ground Floor
HR	.. .. ..	Humana Resources
LR	.. .. ..	Linear Regression
OES	.. .. ..	Overall Environmental Satisfaction
PLC	.. .. ..	Public Listed Company
PHD	.. .. ..	Doctor of Philosophy
SLT	.. .. ..	Sri Lanka Telecom
SLT – HQ	.. .. ..	Sri Lanka Telecom Head Quarters.
Std. Error	.. .. ..	Standard Error.
WS	.. .. ..	Workstation
(OES)	.. .. ..	Overall Environmental Satisfaction; Dependent variable
(L gt)	.. .. ..	Lighting Aspects; Independent vaiable
(P ws)	.. .. ..	Privacy & noise in workstation Environment; Independent Variable
(T wk)	.. .. ..	Boost for Teamwork; independent variable
(V nt)	.. .. ..	Ventilation aspects; independent variable

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CHAPTER I

INTRODUCTION

1.1. Background of the Study

The modern organizations large or small are facing a tremendous competition with its competitors, struggling to survive in ever changing environment. In this context productivity of the organization is a key factor in facing the fears battle within this competitive environment. An organization, irrespective of whether it produces good or service, has to expand/retain its market share for its survival. To do so competitiveness of its products has to be maintained compared to other market players. Hence the productivity of the organization has to be kept on increasing. The above is summarized by Franklin Becker in his article to Facilities journal saying, "Companies large or small, in every industry, face a common challenge: do more, better, with less", (Becker, 2002). In relation to provisioning of work places for employees, the organizations tend to go for most cost effective solutions optimizing available resources. This is highlighted by (Wildre et al, 2015), as 'More large organizations are moving away from traditional private offices and adopting open plan work-environments. This is mainly done to save space and money since office space is limited in both size and usability'.

In attempting to keep the competitive edge of a product the PEOPLE factor is very much important since all the other factors can be acquired by competitors at any time. Hence in increasing the productivity, an efficient, motivated work force is essential.The importance of the people factor over the years can be traced by identifying the changes of Management Approaches over the past.

During the early part of the 19th century, Economic psychology by Munsterberg in 1913 and Scientific Management by Fredrick Taylor were very influential in determining management approaches. The worker was viewed as a potential source of error in the job/working environment. Accordingly the standardized working environments and work routines were developed to minimise the said potential error from the workers.

In 1930s the Hawthorne experiment done by Elton Mayo changed the focus of Management approach from the physical environment to social environment. The Maslow's Hierarchy of Needs theory, Herzberg's Two- factor theory, McClelland's theory of Human motives was emphasized the importance of management attention towards human relations of the PEOPLE factor.

During the recent decades, the importance of the Physical environment has come to a more prominent role again and was highlighted in (Stallworth & Kleiner,1996). Accordingly number of attempts was made to find out the impact of physical/working environment on the productivity of the organization. As per (Gensler, 2005), an UK based architectural magazine, revealed that a better working environment can increase the employee productivity by 19 %.

While focussing the scope to office designs, there are two major types available in literature which are used in designing offices.

1. Open office layouts (Office layouts whose perimeters do not go up to ceiling)
2. Cellular/Enclosed office layouts (Office layouts of which the walls go up to ceiling).

Out of the two above, open office layouts are the most preferred option due to following reasons and widely used for offices today.

- Modern management concepts always encourage team work and Open office layouts improves communication within the occupants and hence teamwork.
- Sudden changes in the Organizational structure are very common due to changes that are taking place within the organizations. Therefore the office layouts are to be changed with minimum time span and minimal cost. Open office layouts are always the preferred option than the cellular office layouts in such situations.
- Space is a prime concern in establishing offices while the cost of construction is another. On the other hand satisfactory working environment has to be provided to the users. Open office layouts always will be the most desired option over cellular offices when considering above aspects.

The above points are highlighted in researches done by (Brennan et al, 2002), (Vogel, 2013), (Van dor voordt, 2003).

Since the office arrangements largely contribute to the working environment of the employees, it directly contributes to the employee satisfaction and hence the productivity. Accordingly design and provisioning of better open office environment is a vital aspect in modern organizations.

1.2. Problem Statement

The volatile nature of the environment of which the organizations exist, requires continuous change / improvement within organizations. Accordingly the office environments too are to be changed frequently to cater the changes in the organization structure and the changes in the work force. In addition, changes/ improvements to the working environment are a common request from the office users. However the above changes or improvements are to be met at a minimal expenditure since the Theme of the modern organizations is to DO more & better with less, (Becker, 2002). Further, above office re-arrangements are to be executed within a limited allocated space, since the space is a very critical and expensive factor nowadays.

Hence the challenge of the Facility Management department of an organization is to provide a modernized user friendly working environment to the employees while considering the organizational constraints.

Open office layouts widely used by facility management teams today. It is observed that users of open office environments have many complaints about their working environment. In-adequacy of allocated space, problems with privacy, disturbances from the co-workers and surrounding, issues related to thermal comfort and lighting are few of them. Accordingly developing a user friendly working environment with minimum issues is very much important.

Hence the researcher is interested in finding out the factors which contributes to high performing open office layouts. Having identified such factors it is suggested to incorporate them in developing open office layouts as far as possible. Further the researcher is interested in finding out the practical difficulties encounter while trying to apply said factors in open offices.

Hence the problem statement of the study is:

"An Analysis of Environmental Factors in Open office Layouts".

1.3. Objectives of the Study

The main objective of the study is to analyze the factors influencing the performance of Open office Layouts in following way.

1. To identify the factors affecting the open office environments in organizations todays context.

2. To find out the relationship between the identified factors Vs Environmental Satisfaction Level of the employees within the open office layouts in Sri Lankan Context.

3. To identify the difficulties faced by organizations in establishing and maintaining open office environments and possible recommendations for betterment of open office layouts.

1.4. Scope of the Study

The researcher is an employee of the Sri Lanka Telecom PLC attached to the Facility Management division. Sri Lanka Telecom Head office located in Lotus road Colombo 01 is selected for the research considering following reasons.

SLT is a Public Listed company and leading player in Telecommunication sector and ranked within best 10 companies in Sri Lanka over the years. It has over 7000 employees all over the island and has more than 3000 employees in SLT head office in various disciplines.

Due to the large competition among the key players, it has under gone number of changes in various aspects. Working environment to the employees is a prime concern in SLT since management believes that a good working environment directly connected with the

productivity. However space is a prime concern within SLT headquarters& suburbs. Accordingly open office concepts are widely used in establishing/refurbishing offices within SLT – HQ as well as regional offices.

Requirements of the employees will also differ for various disciplines / departments. Accordingly the working environments required will also expect to be differing. For example the office requirements for the Finance group might differ from the requirements of marketing group.

Literature review done open office layouts revealed that considerable number of researches has been done on the subject by different researches. Accordingly they have identified number of factors which affect the employee satisfaction in relation to their working environment. While evaluating said factors it is revealed that the essences of such set of factors are apparently same although they are named differently.

A magazine in U.S. General Services Administration, 2006, Gensler, describes about "Hallmarks of the productive workplace" considering 07 factors. Michel Brill in 2001 identified 10 numbers of such factors and named them "work place qualities". Research done by Veitch, J.A.; Farley, K.M.J.; Newsham, G.R., "Environmental satisfaction in open-plan offices" identified 18 numbers of such factors and name them as Environmental satisfaction factors (These factors will be described in details under the literature review chapter). Considering the easiness of analyzing and the simplicity nature (easy to understand by the office users), the researcher selected the 3rd set of factors, namely environmental satisfaction factors as the basis for the analysis.

However it is observed that the factors related to team spirit and furniture of the office are not addressed with the said 18 factors. Accordingly some items in the above were deleted and some are included. Hence the new set of environmental factors which will be used for the study will consist of 21 items. The identified 21 numbers of factors are sub divided in to 4 key sub areas namely Items related to Privacy and Noise in workstation environment, Items related to team spirit, Items related to lighting in the working environment, Items related to ventilation. The items subdivided in to four categories are illustrated below.

(a) . Factors affecting for employees Privacy and Noise in workstation environment.

(a.1). Noise from others conversations around you

(a.2). Frequency of distraction of your work due to others

(a.3). Degree of enclosure of your work area by walls, screens or furniture

(a.4). Level of visual privacy within your workstation

(a.5). Distance between you and others nearby

(a.6). Level of privacy for your conversations

(a.7). Amount of background noise (not speech) you hear at workstation.

(a.8). Size of personnel workspace to accommodate your work, materials, visitors

(a.9). Aesthetic appearance of your office

(a.10). Comfort of the furniture you are provided with

(a.11). Availability of common areas for breaks

(b). Factors affecting the team spirit from working environment

(b.1). Distance to your team mates (peers, subordinates, superiors) from ws

(b.2). Facilities provided within the office to have sudden, informal discussions

(b.3). Availability of meeting/conference rooms within office area

(b.4). Facilities provided within office to have connectivity with your team mates

(c). Factors related to lighting aspects in working environment.

(c.1). Amount/Quality of lighting in your work area

(c.2). Amount of lighting on the desktop

(c.3). Amount of reflected light on your computer

(c.4). Access to day light from your workstation

(d). Factors related to ventilation in working environment.

(d.1). Ability to control temperature in your working area

(d.2). Overall air quality in the working area

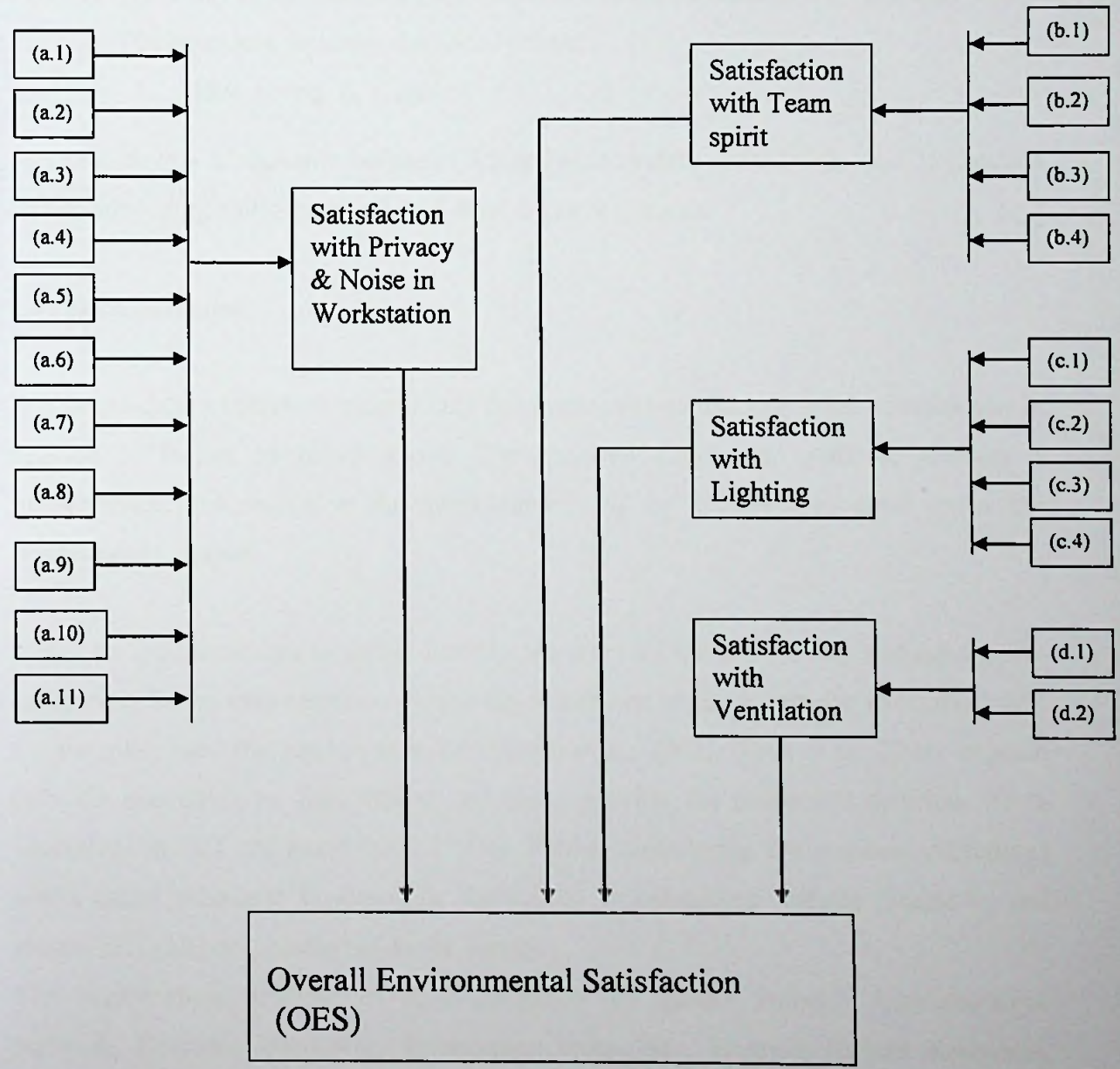
1.5. Significance of the Study

As discussed, organizations today try to increase their productivity by optimizing resources and heavily depend on productivity of its employees. In relation to productivity of employees, job satisfaction is a key factor. Job satisfaction will lead to self-motivated

personnel and in return increase the productivity of the individual worker. As per (**Veitch et al, 2002**), Overall Environmental Satisfaction level is a key factor which affects the Job satisfaction of an Employee. Accordingly overall environmental satisfaction will lead to job satisfaction of the individual employee and hence to the employee productivity.

1.6. Conceptual Framework of the Study

FIGURE 1.1 - Conceptual model of the study



Dependent Variable

(OES)

Independent Variables

(a). Employees Satisfaction with privacy & Noise in working environment.

(a.1), (a.2), (a.3), (a.4), (a.5), (a.6), (a.7), (a.8), (a.9), (a.10), (a.11),

(b). Boost for the Team sprit from the working Environment.

(b.1), (b.2), (b.3), (b.4),

(c). Employees satisfaction about lighting in the working Environment.

(c.1), (c.2), (c.3), (c.4),

(d). Employees satisfaction about ventilation aspects in working environment.

(d.1), (d.2).

Accordingly it can be assumed that the Overall Environment satisfaction is a function of the key 04 independent variables described above.

$$\mathbf{OES} = f(\mathbf{a, b, c, d})$$

Availability of a relationship between OES and independent variables (a,b,c,d) is checked statistically using Null hypothesis and Alternative hypothesis.

1.7. Data collection

It is decided do a survey to measure the Environmental satisfaction level of employee in relation to factors identified above. The required details are gathered through a questionnaire. Preparation of the questionnaire will be discussed in detail under the Methodology chapter.

It will be a difficult task to gather information from all the staff grades considering the complexity in the questionnaire. Hence the researcher targeted only the executive staff. On the other hand the surveys done by (Veitch et al., 2002), (Brill et al., 2001) targeted only the executives in open offices and hence justifies the researches decision. 90 % executives in SLT are based in SLT- HQ. Further considering the practical difficulties which could encounter in executing the survey in outstations, offices located in and around SLT- HQ are selected to do the survey.

The organization structure of SLT comprises 09 groups namely, Administration, Network, Regional, Marketing, Information technology, Finance, Human Resources, Cooperate, Whole sale. However the requirements of executives in technical groups are differ largely. Hence the researcher eliminated the technical related groups from the study and left with only 03 groups (Administration, Finance, Human Resources).

Administration group under consideration consists of 16 executives located in scattered positions in 1st and 2nd floors of CTO building. Renovations in the 2 floors were done before 4 years and significance about the working environment observed less among these executives. Hence the Administration group is eliminated from the study. The Human Resources group is located entirely in the 7th floor of HQ building. However a refurbishment in the floor is not done during last 6 years. Hence this also eliminated.

The finance group has 46 executives in total and located in 2 floors (HQ – 6th floor and 3rd floor of Asset Arcade building). The two floors are completely occupied by the finance group staff and internal refurbishments are done recently in both the floors. Accordingly the 46 executives in the finance group are the best people who feel the advantages and dis-advantages of open office layouts, since they can compare the two situations (Prior to open office and after). Since the requirements of the executives are similar in nature (finance group), it is possible to compare the results of the two offices also. Hence finance group is selected for the study.

1.8. Limitations

1. This study was limited to 46 executives and is consists of one identified category.
2. This study was focused to find out Overall Environment Satisfaction of a Private organization.
3. Sample of the study was taken only from the Head Office of the organization.
4. This study covered only selected factors/variables influencing executives' Overall Environment Satisfaction and hence there may be some other factors influencing the OES of an executive.

1.9. Summary

This chapter described the background for the study, problem statement for the study, and researcher's objectives of conducting the study etc. Researcher focused to brief the significance of the study, how the sample was selected and limitations also. The next chapter summarizes the relevant literature on the scope and objectives of the study.

CHAPTER II

LITERATURE REVIEW

2.1. Organizational Management Approaches.

Prior to describe our main topic, it is worth to glance through the history of evolution of management approaches over the years.

As (Stalworth & Kleiner, 1996) pointed out, before 1930's the focal point of the management was to the physical environment. The worker was considered as a source of error. The management having concerned on the above tried to minimize the possible source of error from the worker by standardizing the work environments and work routines. Economic psychology by Munsterberg in 1913, scientific management by Frederick Taylor are some examples.

(Stalworth & Kleiner, 1996), further states that, this approach was changed significantly in 1930's due to the series of experiments done by Elton Mayo (Hawthorne experiments). These experiments emphasized the importance of management's concern for worker's well-being. The importance of human qualities in work environments were further emphasized by Maslow's hierarchy of needs, Herzberg two factor theory etc.

(Stalworth & Kleiner, 1996) further suggest that during recent past, the management approach has again changed in to the physical environment.

While focus on the management approaches started from physical environment and changed to social environment and again to physical environment, the modern organizations in today's context facing a fears competition among its competitors and struggling to survive. The organizational environment is always changing as well as the customer requirements. Accordingly the organizations too are to be keeping on changing to retain or grab the market share while keeping competitiveness of their products. In

doing so, the organizations have to produce superior goods or services, while keeping or reducing their cost of production.

The challenge faced by modern organizations and its modern theme, whether it is large or small, is summarized by (Becker, 2002) as, '**Do more, better with less'.** This is emphasized by (Becker, 2002) as 'Companies large and small, in every industry, face a common challenge: do more, better, with less. The organizational problems to be solved, while meeting this kind of corporate mandate, are also widely shared: attract and retain high quality employees: strengthen brand identity: increase flexibility in the face of highly uncertain market conditions and new technologies: assimilate mergers and acquisitions: accommodate frequent changes in group and team size and structure'.

Further to above the un avoidable change which the modern organizations are facing is much illustrated in the article by Wendell, J & Grill, T, in the magazine published by U.S. General Services Administration in 2006 (GSA,2006)as, 'Fundamental changes in the workplace are happening today and are driven by a number of factors such as improvements in communication technology, the need to address inefficient management structures, and the desire to better manage risk. This is all taking place at a time, when cost efficiency and competitiveness are paramount'.

2.2. Impact of Working Environment on Organizational Behaviour

Modern organizations are always trying to improve its productivity by effective usage of their resources. People factor is the most important aspect in factors of production since it is the only resource that can be continuously improved by various means. Also the tacit knowledge exist within the employees is the only resource that cannot be acquired or imitated by the other competitors. Hence a well-trained and motivated work force is always an asset and a core competency for an organization.

Hence the organizations are always trying to motivate, update, and improve the skills of their workforce continuously. In this context working environment of the employees is a prime concern among the managers over the years. "Is there any impact of working environment on the performance of the people?" is a widely asked question among the

top management of the organizations. No of researchers tried to answer the above question through various researches done worldwide.

A survey done by an architectural magazine, Gensler, among 200 senior and middle managers in the legal, finance, media sectors in UK during year 2005 was such an attempt to answer the above question. Outcomes from the survey were very vital and it emphasizes that the relationship between the working environment and the employee performance is very much beyond the efficient usage of space, (Gensler, 2005).

As per (Gensler, 2005), the major outcomes from the research are illustrated bellow.

The Productivity Leap ; 'A better working environment would increase employee productivity by 19% according to professionals surveyed', (Gensler, 2005).

Workplace Matters ; 'Four out of five (80%) professionals say the quality of their working environment is very important to their sense of job satisfaction.One third (33%) say that their working environment has been a contributing factor in their decision to accept or reject a job. 58% of respondents don't believe their office has been designed to support their company's business and their own job function. Just half of professionals (52%) rate their working environment as good or very good-the average score of the British office is 3.5(3 being adequate, 4 being good) .More than one third (33%) of professionals believe that their company doesn't consider the quality of their working environment to be a high business priority. This figure rises to 44% in the media sector, 44% in greater London and 47% in the Midlands, (Gensler, 2005).

Brand Control ; 'Professionals split 50/50 as to whether their work place enhances their company's brand. 60% of female professionals don't think that their workplace enhances their company's brand', (Gensler, 2005).

Work styles/Workspaces ; 'Personnel space (39%), climate control (24%) and day light are the most important factors in a good working environment according to professionals we surveyed. Open plan is the dominant office layout, with 62% of respondents' currently working open plan, compared to 28% in their own private office. 7% in small shared private offices and just 2% flexible working, (Gensler,2005).

The private office retains its cachet with half (50%) of professionals saying they would prefer to work in private offices. (30% solo and 20% shared) and one third (33%) of professionals saying they would most like to work open plan, Gensler, 2005).

2.3. Person in working Environment

When considered the facts described above, it is certain that the working environment of employees plays a vital role in enhancing productivity of an organization. But how this working environment fits with the personnel who have various attributes and qualities? The literature regarding the above discusses about a new emerging discipline called Environmental Psychology.

As per (Stalworth & Kleiner, 1996), Environmental psychology originated in Lewinian thoughts and has its bases in fields of Architecture and interior design. Furthermore it includes the effects of the physical factors like crowding, noise, temperature variations, colours upon the psychological wellbeing, satisfaction, behaviour, performance of the people.

2.3.1. Person – environment fit

This discusses about the suitability and acceptance between the person and his working environment between each other. As per (Stalworth & Kleiner, 1996) Person – Environment fit is two folded.

1. Needs of the person and ability of the working environment to meet the mentioned needs.
2. Demands of the environment and ability of the person to fulfill such needs.

In essence as per (Stalworth & Kleiner, 1996), 'All of the thought and statements concerning office design and its relationship to employee satisfaction and productivity and its implementation will in some way perhaps the person environment fit'.

2.3.2. **What is an optimal Office?**

If a working environment and the person who is occupying the particular environment are fit in to each other while satisfying the two fits described above, it is called an optimal office design. As per (Stallworth & Kleiner, 1996), 'An optimal design is one where the environment supports the needs of the worker and where the worker is operating in an environment most conducive to the individual's abilities'.

2.4. **Open Offices vs. Cellular Offices**

As per the findings described above, working environment of employees is a very important aspect when considering the performance and productivity of them. Accordingly modern organizations are much concern about working environment of their employees. However a balance between utilization of resources and the employee requirements are to be maintained when designing office environments. Because resources like space etc. are very scarce in nature and observed costly.

On the other hand organizational structure and the office arrangements are rapidly changing to cater the environmental changes where the organization exists. Hence the office arrangements too must capable enough to support such changes while catering the theme of modern organizations.

All of the above facts are to be considered when designing office arrangements in today's context. What are the methodologies available in the literature in designing office arrangements will be a vital question in this situation. The literature available focuses on two key major categories namely "Open – Plan offices" and "Cellular/Enclosed offices". However the effectiveness and impact on productivity of the above two categories are in debate while some are rely on open offices and the others with cellular offices.

As per (Haynes, 2008), although the two terms, open offices and cellular offices are widely used in the literature, there are no clear cut definitions for them. However (Brill et al, 2001) proposed few definitions for the key words in open office layouts.

Work Place :- The term used for the entire physical environment allocated for the work, i.e. total building, total floor etc. It is a combination of large number of work spaces.

Workspace :- The allocated area specially for an employee and where he occupies in most of the time.

Private (Cellular) Office :- A specified workspace demarcated by four walls continue up to the ceiling with a door.

Open (Plan) Office :- A specified workspace where the boundaries of the allocated space do not continue up to the ceiling level.

(Stallworth & Kleiner, 1996), discussed about the "person environment fit" within the office layouts. However it is observed that productivity losses could be attributed to a mismatch between the office environment and the work undertaken in that environment. Accordingly it is observed that mismatch of the office environment and the work undertaken will lead to productivity losses and hence are to be avoided. In designing best fit optimal design, requirements of the user are to be taken and verified to get the optimum usage.

As per (Haynes, 2008), simplified 4 categories on the usage patterns of office were identified by Laing et al in 1998. The 4 categories are as follows.

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 work stations 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 shred tasks based settings serve both concentrated individual and group interactive work. Accordingly (Haynes, 2008), suggested consulting the occupiers at all the stages of the office layout designing to ensure that an optimum office layout is achieved.

2.5. **Minimalist Zero Based Approach**

While the office designers are trying to match the requirements of users with efficient working environments in terms of optimal designs, the organizations in today's context are facing severe challenge for their survival. The market conditions are very volatile today. Surrounding environment and customer expectations are keep on changing. For an organization to be survived in this volatile market, it has to change its strategies all the time to align with the market trends and demands. Accordingly the organization structure needs to be changed to cater the new trends and hence the office arrangements considering the theme of modern organizations of (Becker, 2002), "Do more and better with less".

As emphasized by (Bradley, 2003), 'The ability to respond to changed market conditions, new opportunities or other stimuli depends upon being able to deploy people and their information to where they can be effective, as quickly and inexpensively as possible. Traditionally, congregating teams or regrouping whole segments of the organization means providing new space physically to co-locate the players involved and providing suitable adjacencies and interconnections to enable new relationships to be developed'.

To address the above situation a minimalist Zero – based approach for office design has been developed. According to (Bradley, 2003), 'A minimalist, zero-based approach to workplace design can create the environmental conditions to encourage increased organizational mobility and agility while at the same time reduce overall occupancy cost'. Considering above approach, open office layouts are far ahead of the cellular offices in office designing today.

2.6. Characteristics of a Good Open Office

Having understood the importance of Open offices in developing productive offices, it is vital to know what are the main qualities or components of a good open office layout. The topic has been discussed in number of literature available for the subject.

The magazine published by U.S. General Services Administration in 2006 (GSA, 2006), "**Innovative Work Places: Benefits and best practices**" provides some valuable information related to above. As per (GSA, 2006), the competitive nature of businesses requires flexible workplaces with high tech features. Since most of the modern organizations are focused with more project – based work with teamwork, easily changeable work places are of high demand. This is highlighted by (GSA, 2006) as, 'In today's highly competitive global business environment organizations are increasingly revisiting their workplace strategies. Why? Because fixed office space and inflexible work arrangements provide little or no value to most organizations. Flexible workplace strategies are required to accommodate the rising mobile workforce. Today's generation of workers expects adaptable office environments with high-tech features. Collaborative office environments are also on the rise, as team-and project-based work is becoming the predominant work at style'.

Further it states that a more complex formula for work place is emerging and described it as follows.

Work Strategies + Space + Culture = Workplace.

Further to above (GSA, 2006), describes the factors which affects the productivity and job satisfaction and categorizes them as major and moderate.

Major Impact

- Technology - Providing the right technological tools and support to work effectively.
- Storage Space - Supplying ample storage within close proximity to their desk.
- Climate Control - Allowing employees to control the workplace climate to provide comfort.

- Quiet place - Minimizing noise that causes distractions and disruptions.
- Adjustable & adaptable space -Supplying space that can be personalized to fit an individual's work style.

Moderate Impact

- Personal lighting control.
- Ergonomic equipment and chairs for physical comfort.
- Proximity to exterior windows, providing natural light and views.
- Privacy and space for personal items at the workstation.
- A visually appealing workplace with a professional atmosphere.

(GSA, 2006), emphasizes the importance of designing the modern work places by considering the views of all the stake holders of the office. It introduces the term 'Innovative Workplaces' for so designed offices and define them as follows, 'Innovative workplaces are cost effective, flexible, and sustainable work environments that support organizational change and collaborative work styles'. The goal of an innovative workplace is to provide high performance work environments that maximize employee productivity and reduce long term operating expenses.

Designing an 'Innovative workspace is a challenge and involves lot of skills which (GSA, 2006) describes as, 'Designing innovative workspaces requires new ways of thinking about the physical and virtual aspects of the space-tying together people, space, and technology to support changing (and more progressive) business practices. This approach requires an integrated development process, balancing business strategies, short and long term costs, and occupant performance. During this process, organizations must collaborate closely with all parties affected by workplace decisions including building owners, designers, facility managers, leasing experts, and occupants. By using this integrated approach, workplaces are more effective and offer the best value to all stakeholders'.

Further **(GSA, 2006),** has identified characteristics of an Innovative workplace and named them 'Hallmarks of the productive Workplaces' which detailed as bellow.

Spatial Equity

A humane, well – designed workspace that meets the user's functional needs and provides individual access to privacy, daylight, outside views and aesthetics.

Healthfulness

Clean and healthy work environments with access to air, light and water-and free of contaminants and excessive noise.

Flexibility

Easily adaptable workplaces that support varied work strategies and help balance an individual's work and home life- including systems and furnishings that accommodate organizational change with minimal time, effort and waste.

Comfort

Temperature, ventilation, lighting, acoustic and furniture systems, which could be adjusted by occupants, providing personal and group comfort.

Connectivity

A robust communications system providing access to people and/or data from any place, at any time.

Reliability

Efficient and state of the art building, security, computer, and telecommunication systems those are easy to maintain.

Sense of Place

A workplace that has a unique character, with an appropriate image and identity, instils a sense of pride, purpose, and dedication for the individual and the workplace community.

In addition to the 'Hallmarks of the Productive workplaces' described lengthily above, sustainability is a vital aspect of an "Innovative workplace". As per (GSA, 2006) 'sustainable workplace' will include following key qualities.

- **Integrated design process**

  Focused on adaptability and mobility, environmental issues, ergonomics, collaboration, privacy, and noise control.

- **Healthy Environment**

  With more daylight, outside views and fresh air.

- **Flexible Systems**

  Such as ergonomic equipment, chairs, and keyboards; flexible monitor location; and moveable task lighting.

- **Occupant Control**

  Of lighting, heating, and cooling systems.
- **Alternative work strategies**

  Including Telework programs and centers, desk sharing, touchdown space, and remote information access.
- **Flexible workplace strategies**

  Such as community space and ample private space; cell phones laptops.

Further (GSA, 2006) emphasizes, 'Integrating "sustainable workplace" features with the "Hallmarks of Productive workplace" approach that only creates a healthy and productive work environment but also delivers significant additional benefits to the organizations'.

Bosti Associates, a pioneering Architectural organization has done number of researches in relation to the effects of the workplaces on worker performance. An experiment done during 1994 to 2000 studying and analysing 13000 cases came up with remarkable results. The results include the key qualities of a good works place also. The essence of the outcomes is summarized in (Brill et al, 2001) and has identified 04 trends that drive the work place changes. They are,

1. Organizational structures and strategies.
2. Workforce attitudes and expectations.
3. Technology – It's ever increasing power and widespread deployment.
4. New recognitions about and strategies for the workplace.

Further, (Brill et al., 2001), 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. Workplace comfort, ergonomics and enough space for work tools.
5. Workplace side-by-side work and "dropping into 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.

A research done by collecting data from a field study in the Cost -Effective Open – Plan Environment (COPE) project is another important one. This was done by a group of researchers namely Jennifer A. Veitch, Kate E. Charles, Kelly M.J. Farely, Guy R. Newsham in a field study, (Veitch et all, 2002),(that included local physical measurements of each participant's workstations. This was conducted among 779 open – plan office occupants from nine government and private sector office buildings in five large Canadian and US cities.

(Veitch et all, 2002), identified 18 environmental satisfaction items which can be grouped in to three factors namely Privacy/ Acoustics, lighting and ventilation/Temperature. The identified environmental factors are,

1. Amount of light on the desktop.
2. Overall air quality in your work area.
3. Temperature in your work area.
4. Aesthetic appearance of your office.
5. Level of privacy for conversations in your office.
6. Level of visual privacy within your office.
7. Amount of noise from other people's conversations while you are at your workstation.
8. Size of your personnel workspace to accommodate your work, materials and visitors.
9. Amount of background noise (not speech) you hear at your workstation.
10. Amount of light for computer work.
11. Amount of reflected light in the computer screen.
12. Air movement in your work area.
13. Your ability to alter physical conditions in your work area.
14. Your access to a view of outside from where you sit.
15. Distance between you and other people you work with.
16. Quality of lighting in your work area.
17. Frequency of distraction from other people.
18. Degree of enclosure of your work area by walls, screens or furniture,

Whether you consider the "Hallmarks of the Productive Workplaces" described in (GSA,2006) or the "Work place Qualities" by (Brill et al., 2001) or any related literature which describes the qualities of modern workplaces, the essence of the qualities as a whole are observed more or less same all though different wording and phrases are used.

Since the 'Environmental factors' described in (Veitch et al, 2002) are descriptive and easy to analyse, it is decided focus on them in evaluating the Office Layouts during the course of research.

Although the open offices are widely used in modern office layouts it is observed that the distraction due to noise is a key concern and creating negative impacts for the productivity. As (Haynes, 2008) describes, distraction that can be taken place by the other people conversations and activities increases with the increase of number of occupants in an open office. Table below supports the above.

	Rarely Distracted (Percent)	Frequently Distracted (Percent)
Single room Occupant	48	29
Double – Room Occupant	30	52
Open Plan office	19	65

Table 2.1 : Type of office and distraction by other peoples conversations.

Source : (Haynes, 2008).

However the Open – Plan Offices observed less expensive and require minimum alterations saving cost and time.

As per (Becker, 2002), Office environments can be used as a brand identity since it is an illustration of the management thinking towards the employees and can be used as a tool to retain the employees.

(Veitch et al., 2002), emphasized that the organizations adopt open office arrangements aiming at reducing the accommodation cost. The facility managers responding to the increased pressure by the management to reduce the occupancy cost develop open offices with reduced space. This may lead to the risk of creating office environments which are

uncomfortable to the users and the effects on individuals could be directly by adverse physical conditions or indirectly through lack of privacy and stress and should be avoided.

(Van der Voordt, 2004) had discussed the pluses and minuses of Open – Plan office layouts.As per (Van der Voordt, 2004), the open office environments benefit the organizations by improved teamwork and improved communication. However there may be negative effects like occupier experiencing loss of privacy and distraction by noise due to increased crowd.(Van der Voordt, 2004) further describes that the open office occupiers experience an increased stimuli in terms of visual and acoustic than in a cellular office. However the occupiers may respond to this increased stimulus in a positive way as well as a burden. The aim of a high performing work place is to match the requirements of the users as well as the organizational requirements with a deep analysis. (Van der Voordt, 2004) attempted to address the issue by introducing the concept call combi-office environments. He emphasized the importance of increasing the shared areas in an office layout. It is important to have office environments which can transfer information freely with increased team work. However it should be acknowledged the requirement for concentrated work too. The right balance between the two has to be maintained by analysing the occupier's requirements and the work processes.

2.7. **Recommended Space Allocations in an Office Layout**

Space allocated per person is very much critical in an office layout. The employee has to be provided with adequate and sufficient space to cater his functional requirements. On the other hand space allocated will be a critical factor for organization since it is a considerable cost factor. As per (Becker, 2002), Theme for modern organizations is to "Do more, better with less" and the space allocation should be balanced between two considerations stated above.

Accordingly literature is reviewed to find out some recommended guidelines available for space allocation worldwide. The (GNWT, 2003), provides some useful guidelines for office space allocations. Following are the categories of Workstation spaces (according to the job functions) and recommended spaces for each as per the (GNWT, 2003).

Space Type	Functional Assignment	Space Allocation	
		Sqm	Sqft
Enclosed Type A	Frequent meetings with up to four others and/or requiring confidentiality, security, visual and acoustical privacy.	22.5	240
Enclosed Type B	Frequent meetings with up to two others and/or requiring confidentiality, security, visual and acoustical privacy.	13.9	150
Enclosed Type C	Frequent meetings with up to two others and/or requiring confidentiality, security, visual and acoustical privacy. Typical assignment for position involved with counseling, human resources management or other sensitive situations requiring ongoing visual and acoustical privacy.	9.3	100
Open Type D	Concentrated multi-source paperwork: compiling information, reading writing, analyzing, calculating and referencing multiple source of material; allows for manual and automated drafting functions. Typical assignment for managerial, professional or technical staff	9.3	100
Open Type E	Multi-task paper intensive work: telephone work, keyboarding, filing, sorting documents, handling mail, editing, operating equipment, scheduling, receiving visitors.	6.5	70
Open Type F	Specific, task oriented work, focusing on data input into electronic media. Typical assignment for clerical and data-entry staff	4.5	50

Table 2.2 : Recommended workstation sizes

Source : (GNWT, 2003)

Further to above, (GNWT, 2003), recommend some spaces for the support functions as well.

Support Space	Typical Space Allocation and Functional Assignment
Filing Cabinet	Allow 1.0Sqm (11 Sqft) per filling cabinet.
Plan Cabinets	Allow 1.5Sqm (15 Sqft) per plan storage cabinet.
Storage Shelf Units, storage rooms	Allow up to 1.0Sqm (10 Sqft) per shelving unit either free – standing or within storage rooms.
Photocopier area	Allow 5.0Sqm (50 Sqft) for standard photocopying requiremens to include paper storage and work spaces.
General Work area	Allow up to 5.0Sqm (50 Sqft) for common/ shared workstation for functions such as mail sorting, computer equipment , facsimile machine etc.
Reference Library	Allow 1.0Sqm (10 Sqft) per shelving unit. Allow 5.0Sqm (50 Sqft) per reading and work table.
Local Area Network (LAN) computer room	Space allocation determined on a case by case basis taking in to account equipment footprint and other functional requirements.
First Aid room	First Aid room will be provided based on regulations under the safety act. For buildings with multiple departments, space for first aid room will be allocated based on number of FTEs in each department.
Reception area	Space allocation based on functional needs; e.g . visitor/customer , traffic, security requirements etc.
Quiet Rooms	Allow one quiet room of 9.3 Sqm (100 sqft) for every 10 open workstations.
Meeting Rooms	Meetings of 4 to 5 people allow 11.15 Sqm (120 Sqft) Meetings of 6 to 7 people allow 13.90 Sqm (150 Sqft) Meetings of 12 people allow 22.30 Sqm (240 sqft)

Table 2.3 : Recommended Support Space sizes

Source : (GNWT, 2003)

(OSH Canada, 2012) also provide some recommendations for office spaces.

As per (OSH Canada, 2012), 'Office spaces should allow for easy movement, accommodating visitors where necessary, and storage'.

Application	Minimum Ranges	Requirements
Two people can meet in an office with a table or desk between them – such as a supervisor and an employee.	60" - 72"X 90" - 126"	152 – 183 cm X 228 – 320 cm
A worker has a primary desk, and a secondary surface such as a credenza.	60" - 72"X 60" - 84"	152 – 183 cm X 152 – 213 cm
Executive office : 3-4 people can meet around a desk	105"- 130"X 96" - 123"	267 – 330 cm X 244 – 313 cm
A basic workstation – such as call centre	42" - 52"X 60" - 72"	107 – 132 cm X 152 – 183 cm

Table 2.4 : Office space recommendations.

Source : (OSH Canada, 2012)

(OSH Canada, 2012) discuss about 4 categories of work spaces according to 4 worker profiles.

- **Leadership** : 10 Sqm – maximum of 18.5 Sqm. Leadership workers can be allocated an enclosed office but it is not mandatory and it is an allowance not an entitlement. Examples Director, Director General or higher.
- **Fixed** : Maximum of 4.5 Sqm. Employees who are at their desk more than 60% of the day. Examples Policy analyst, Administrative Assistant, Call/Contact Centre operator, Translator.
- **Flexible** : Maximum of 3.0 Sqm. Employees who are at their desk approximately 40% of the day. Examples Account Executive, Auditor, part time Teleworker, inspector.
- **Free Address** : maximum of 1.5 Sqm. The nature of the employees' work does not require them to have an individual dedicated workstation in the office. They will generally only drop in for short amounts of time on a periodic basis to meet with colleagues, catch up on projects or simply make social connections. Example Consultants, remote workers, regional employees, full-time teleworkers. It should be noted that the free address workstations are not assigned to any specific employee", (OSH Canada, 2012).

2.8. Some Useful Ergonomics in Office Layouts

The Ergonomic Handbook published by Occupational Health Clinics for Ontario Workers Inc., (OHCOW, 2007) provides us some useful information about office ergonomics. (OHCOW, 2007), gives a definition for Ergonomics as 'Ergonomics can be defined as fitting the job to the worker. All workers are not the same size and everyone has limits. Ergonomics aims to design workstations, work processes, equipment, and tools to fit you. As a worker, it is important that you know how to adjust your office workstation to suit you'.

It further mention that if a worker is not fit to the work assigned then there is threat of worker being exposed to risk factors that may lead to musculoskeletal injury.(OHCOW, 2007) categorizes the risk factors as bellow.

- **Repetition** : Tasks or body movements carried out over and over again.
- **Awkward postures:** Body positions that are not considered neutral or ideal such as twisting your neck to view your monitor or reaching forward or to the side to use your mouse.
- **Static forces** : maintaining a position for a long period of time (i.e. prolonged sitting, viewing the monitor with a bent neck, or reaching for the keyboard)

It emphasizes the importance of the correct posture in sitting in your workstation.

Wrists : Naturally straight position; not bent up, down, or from side to side.

Elbows : Bent approximately between 90 and 100 degrees (right angle), close to your body, and supported if possible.

Shoulders : Relaxed (not slouched or raised).

Neck : Facing forward and not looking up, down or to either side.

Hips : Bent around 90 degrees with your thighs roughly parallel to the floor.

Low back : Supported to maintain its natural curve.

Knees : Bent at approximately 90 degrees with enough space between the back of your knees and the chair to place your fist. To rest if correct, you should be able to place your closed fist between the spaces.

Feet : Placed flat on the floor or supported by a footrest.

As per (OHCOW, 2007), office chair is the one of the most important part of one's workstation. The chair selected should fit in to the task expected from the occupant. A generalized chair may not suit every worker in the office and may need some alterations according to the tasks assigned as well as body measurements.

As per (OHCOW, 2007), following features are part of a good office chair. A chair is only Ergonomic if you can adjust it to fit you.

General

- 5- caster swivel base
- Adjustments can be made easily while sitting in the chair

Seat pan

- Rounded front edge
- Wide enough and deep (long) enough to fit you comfortably
- Adjustable in angle
- Firm padding covered with non-slip, breathable fabric

Backrest

- Curved to fit the shape of your back
- Padding for the low back area Height adjustable (separate from seat pan)
- Adjustable angle with locking mechanism
- Wide enough and high enough to fit your back comfortably while you work

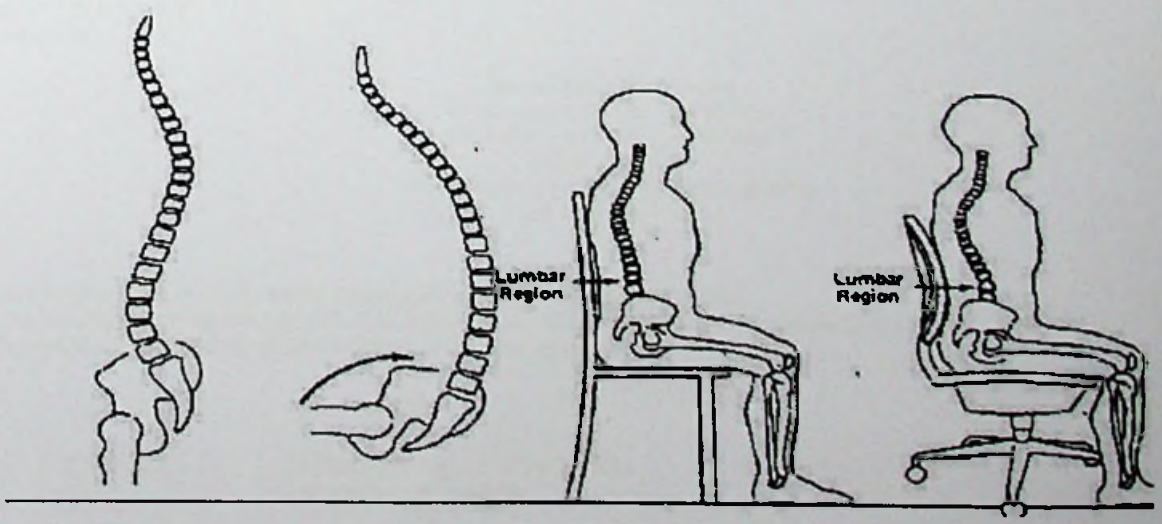
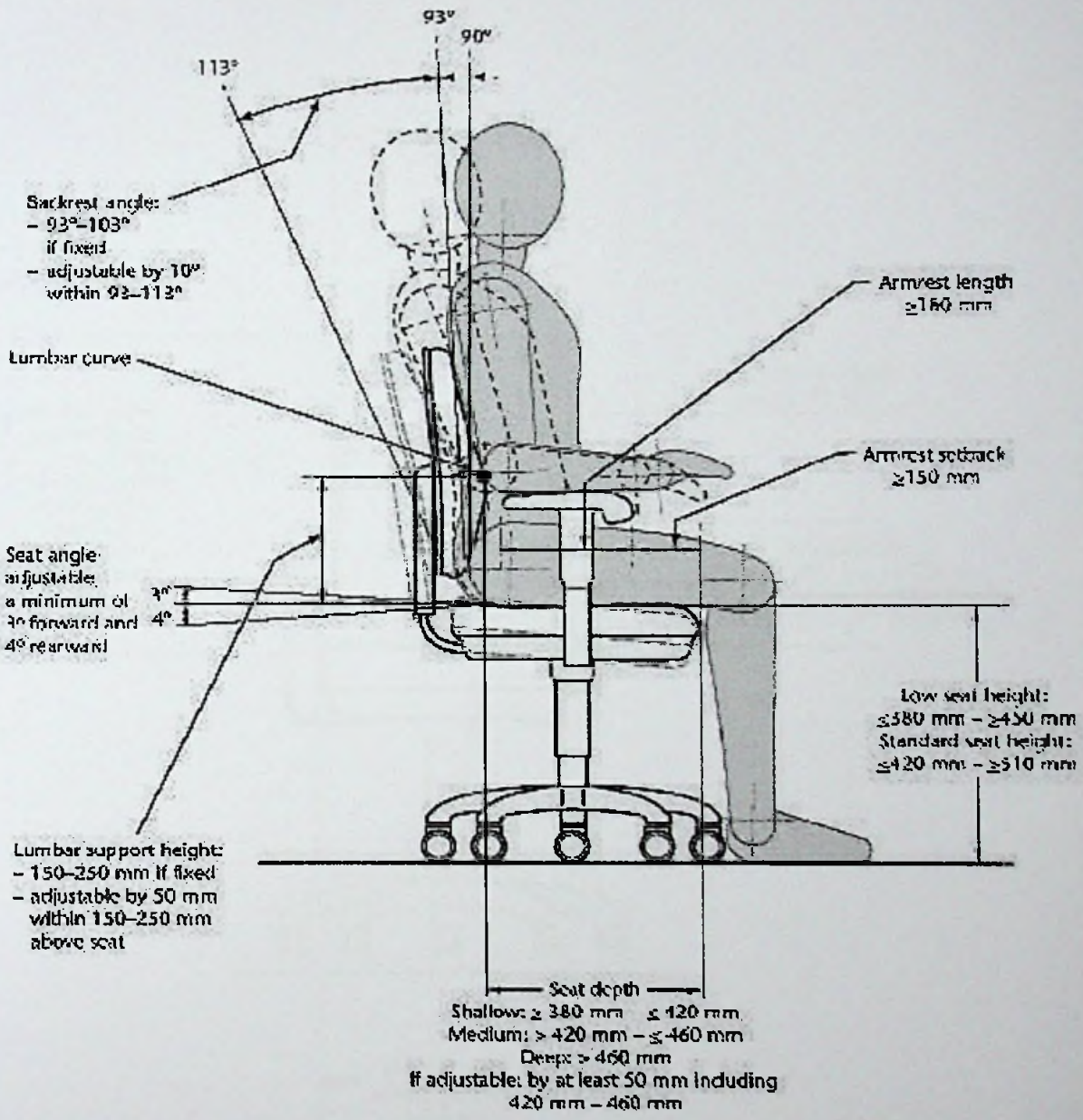


Figure 2.1 : Recommended Curvature for Backrest
Source : (OHCOW, 2007)

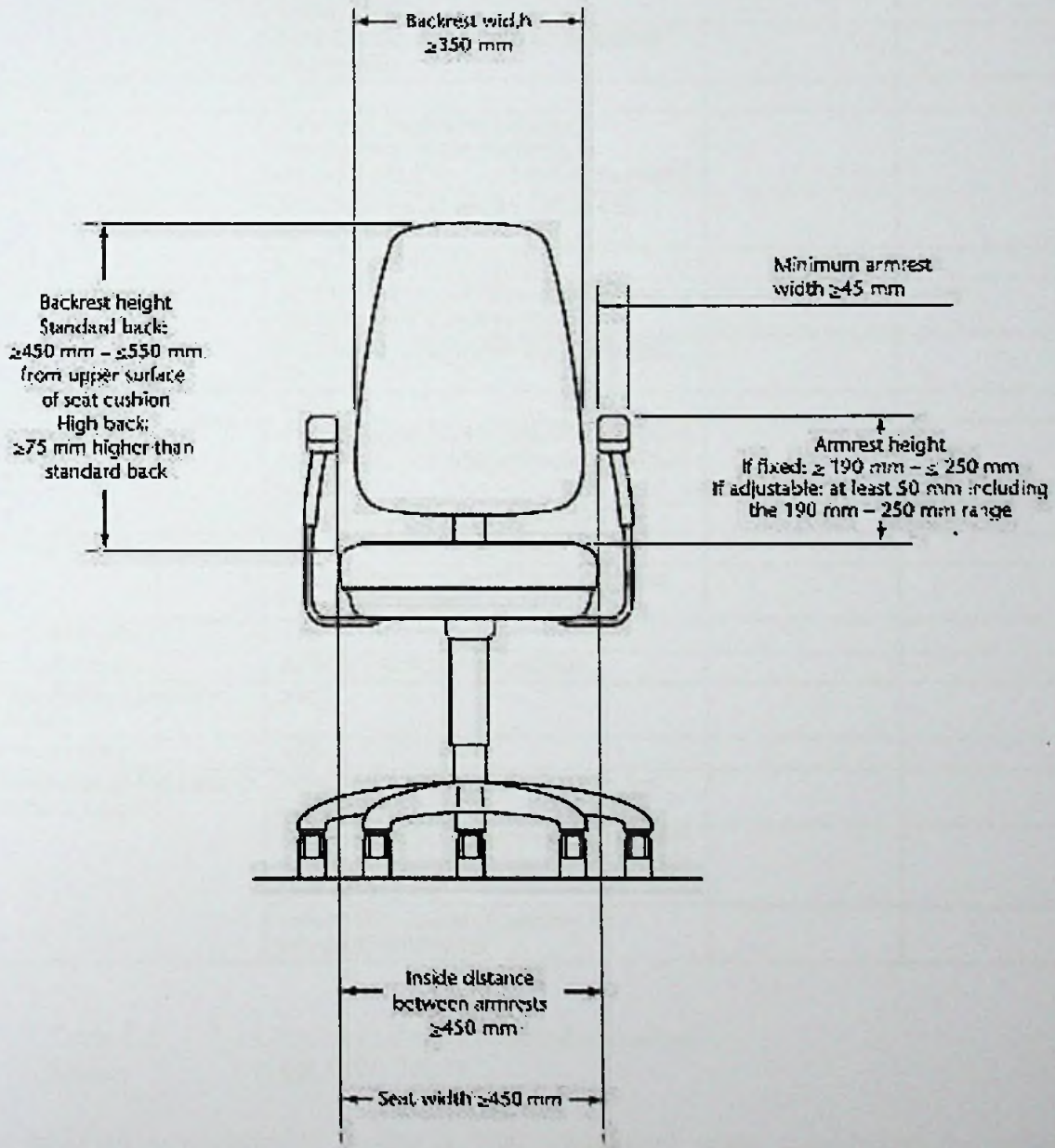
Armrests

- Allow chair to slide under work surface
- Ideally height and width adjustable
- Easily removed if in the way while you work.



Note: *Refer to the text to understand principles and for more detailed information.*
Based on accommodating 5th percentile female body dimensions to 95th percentile male body dimensions using the Natick "1988 Anthropometric Survey of US Army Personnel" (Gordon et al.)

Figure 2.2 : Qualities of a Good Chair
Source : (OHCOW, 2007)



Note: *Refer to the text to understand principles and for more detailed information.*
Based on accommodating 5th percentile female body dimensions to 95th percentile male body dimensions using the Natick "1988 Anthropometric Survey of US Army Personnel" (Gordon et al.)

Figure 2.3 : Components of a Good chair
Source : (OHCOW, 2007)

APPENDIX D (Metric)
Checklist of workstation dimensions (mm)

Workstation parameter	Recommended dimension (mm)	Your measurement	Acceptable?
Chair			
Seat height	Low seat height: ≤380 to ≥450		
	Standard seat height: ≤420 to ≥510		
Seat depth	Shallow: ≥380 to ≤420		
	Medium: >420 to ≤460		
	Deep: >460		
	If adjustable: by at least 50 including 420 to 460		
Seat width	≥450		
Seat angle	If the seat angle is adjustable independent of the backrest: a minimum of 3° forward and 4° rearward		
Lumbar support	Adjustable by 50 within 150 to 250 above seat		
	If fixed: within 150 to 250		
Backrest height	Standard back: ≥450 to ≤550 from upper surface of seat cushion		
	High back: ≥75 higher than standard back		
Backrest width	≥350		
Backrest angle	If the backrest is adjustable independent of the seat: 10° within the range of 93° to 113°		
	If fixed: within range of 93–103°		
Armrest height	If fixed: within 190 to 250		
	If adjustable: at least 50 including the 190 to 240 range		
Armrest length	≥180		
Armrest setback	At least 150 from front of seat		
Inside distance between armrests	≥450		
Armrest width	≥45		
Movements of the seatpan and back support	Independent: see backrest angle and seat angle		
	Concurrent tilt: seat minimum 10° with minimum concurrent backrest tilt of 15° (1.5:1 ratio)		
	Unison tilt: seat and backrest tilt in unison 15° rearward		

Table 2.5 : Checklist of workstation dimensions
Source : (OHCOW, 2007)

The table in a workstation is also a vital component when considering the office Ergonomics. It is often possible to add adjustable accessories to the desk and is recommended. As per (OHCOW, 2007), there are several methods of achieving adjustability.

1. One may purchase a **complete workstation** that allows for both regular desk work and space for the computer. The computer section should have an adjustable

portion for the keyboard and mouse, and a separate adjustable portion for the monitor. The portion of the desk designed for the keyboard should have enough space for the mouse to be placed at its side.

2. One may add attachments to the desk such as keyboard and monitor trays.

3. One may use a smaller separate computer workstation and continue to use the desk for regular work.

If you have shelves above the workstation, ensure they do not interfere with adjusting the monitor height or block overhead lights.

- Sit with your arms hanging straight at your side (Figure 2.4)
- Adjust the writing surface to be level with your elbows (Figure 2.4)
- Raise forearms to create approximately a 90-degree angle at the elbow (Figure 2.4).

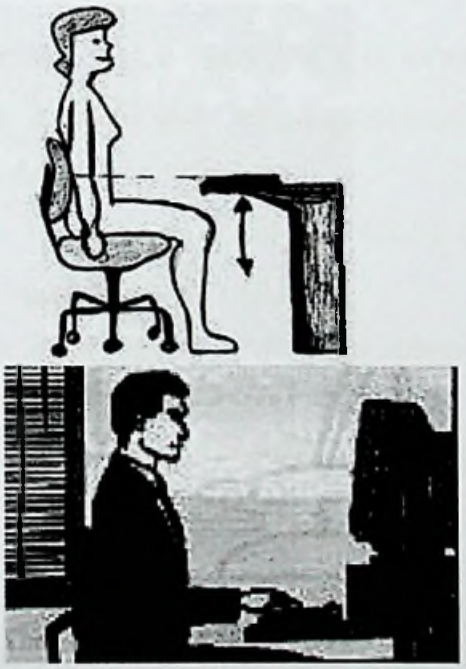


Figure 2.4 : Recommended posture for sitting on a workstation
Source : (OHCOW, 2007)

Some workers prefer sit/stand stations since it allows them to change their posture depending on the tasks they are performing.

A: THE WORKING SURFACE IS TOO HIGH

- Sit with arms hanging straight at your side (Figure 2.4)
- Raise your chair until the desk is level with your elbow.

- Use a footrest to support your feet. Remember to keep a 90-110 degree angle at the knee (Figure 2.5)
- Raise your forearms to create approximately a 90-degree angle at the elbow (Figure 2.5)

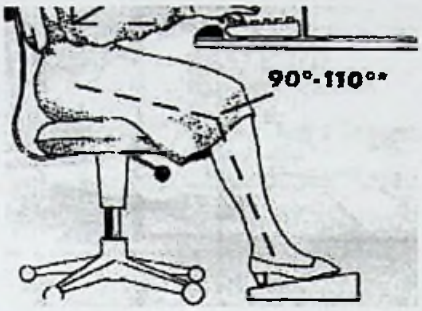


Figure 2.5 : Recommended postures for sitting
Source : (OHCOW, 2007)

B: THE WORKING SURFACE IS TOO LOW

- Raise the desk using a stable support such as blocks under the desk to raise it (Figure 2.6).
- Raise the desk until the working surface or keyboard is at the level of the elbow (Figure 2.6).
- Raise the forearm to create approximately a 90-degree angle at the elbow (Figure 2.5).
- Purchase desks in the future that are height adjustable

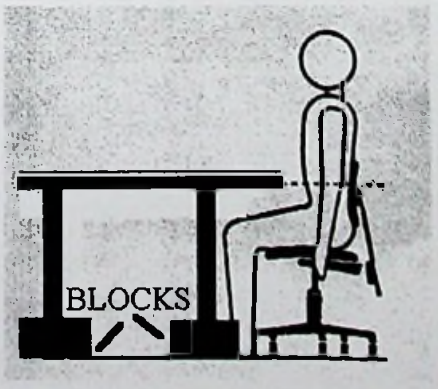


Figure 2.6 : Recommended postures for sitting
Source : (OHCOW, 2007)

2.9. Recommended Illumination Levels in Office Layouts.

Illumination Level inside the offices is very much important aspect when considering the health and safety of the employee as well as his performance. The required amount of lighting intensity (illumination levels) for the offices can be provided in two ways, either by naturally or artificially. It is always recommended to use natural means as far as possible. However the importance of artificial lighting arrangements cannot be ignored since the required amount of illumination has to be provided inside offices as per the work executed inside the offices.

There are various literatures available which provides the recommended illuminance levels inside office arrangements. The code for Interior Lighting by CIBSE (Charted Institute of Building Services Engineers) provides some good guidelines for above.

Illuminance (lux)	Activity	Area
100	Casual seeing	Corridors, changing rooms, stores
150	Some perception of detail	Loading bays, switch rooms, plant rooms.
200	Continuously occupied	Foyers, entrance halls, dining rooms.
300	Visual tasks moderately easy	Libraries, sports halls, lecture theatres.
500	Visual tasks moderately difficult	General offices, kitchens, laboratories, Retail shops.
750	Visual tasks difficult	Drawing offices, meat inspection, chain stores.
1000	Visual tasks very difficult	General inspection, electronic assembly, paint work, supermarkets.
1500	Visual tasks extremely difficult	Fine works and inspection, precision assembly.
2000	Visual tasks exceptionally difficult	Assembly of minute items, finished fabric inspection.

Table 2.6 :- Recommended illumination levels inside offices;
Source : CISBE Code for Lighting part 2 (2002).

Further CISBE describes the lighting requirements as per the functionality of offices.

Area	Illuminance (lux)
Filling , copying etc	300
Writing, typing, reading, data processing	500
Technical drawing	750
CAD workstations	500
Conference and meeting rooms	500
Reception desk	300
Archives	200

Table 2.7 :- Recommended illumination levels as per functionality
Source : CISBE Code for Lighting part 2 (2002)

Considering above, we can conclude that a light intensity of 500 lux is required for the offices we are concerned with.

CHAPTER III

METHODOLOGY

3.1. Introduction

The chapter describes how the researcher conceptualizes the research study according to the findings from the literature review. Literature review revealed that there are number of variables which affect the overall environmental satisfaction level of an employee. The chapter summarizes how the researcher finalized the variables on his findings, research design according to them, measuring the variables, conceptual model of the study, hypotheses to ascertain the relationships, presentation of data, and data analyses.

3.2. Research approach

The research study will be based on following two structures namely,

1. Conceptual structure
2. Empirical structure

Above two structures are analyzed by Deductive (Quantitative) research approach. Accordingly the more general theories,` findings available in the literature are deduced to more specific terms to suit with the research study and will be analyzed using various tools available.

Figures 3.1 and 3.2 illustrate the Deductive Approach for Conceptual and Empirical structure in relation to the study.

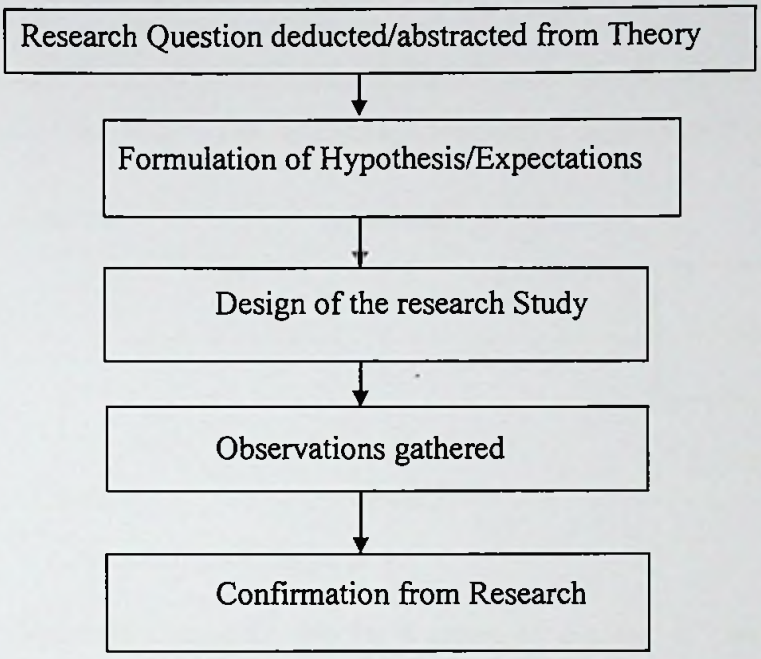


Figure 3.1 : Deductive approach for conceptual structure

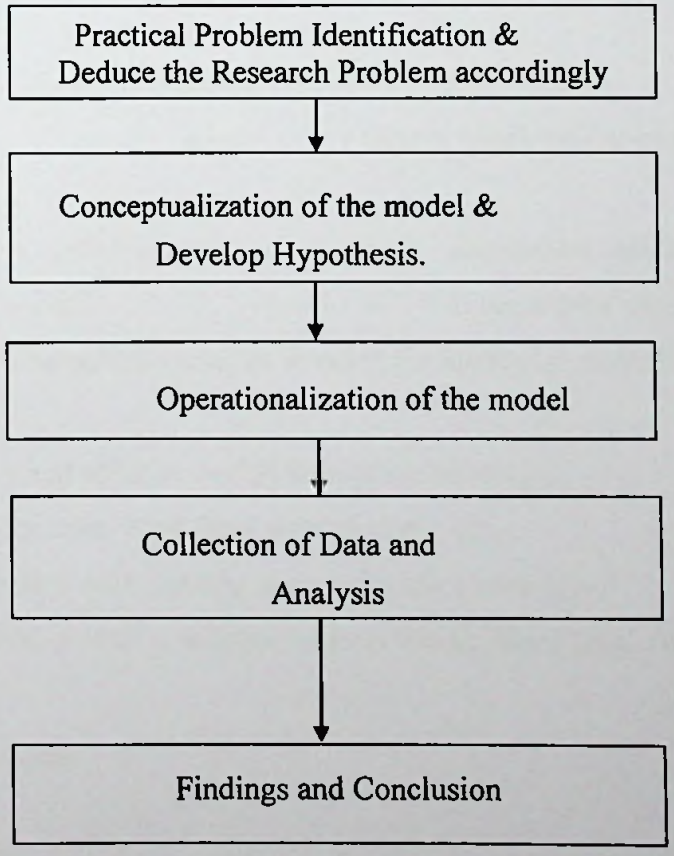


Figure 3.2 : Deductive approach for Empirical structure

3.3. Research Design

The research will be based on the causal design. It searches the effect of one variable on the final output of the study. The following Cause effect diagram will brief the idea.

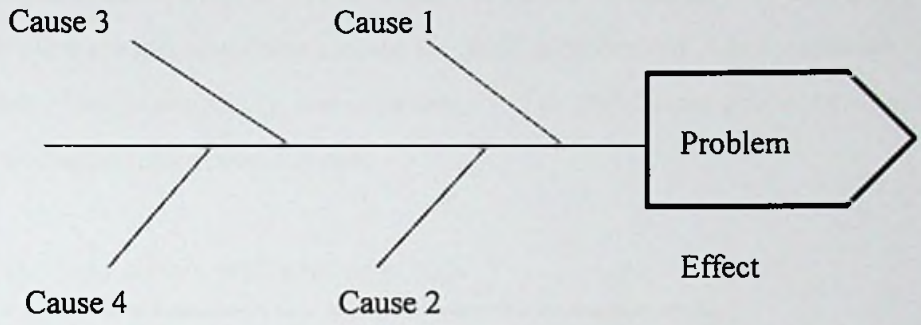


Figure 3.3 : Cause & Effect diagram

The final problem we encounter will be a result of number of causes which can be identified and is illustrated in the above figure 3.3.

The relationship can be expressed in mathematical terms as bellow.

Overall Environment Satisfaction (OES) = f (a, b, c, ...)

a,b,c, ... = factors which influence OES

Overall Environment Satisfaction ⟶ Dependent variable

Factors influencing OES ⟶ Independent variables

Accordingly the independent variables selected for the study are as follows.

1. Privacy and noise in workstation environment (a)
2. Boost for team work from workstation (b)
3. Satisfaction with lighting aspects in office area (c)
4. Satisfaction with ventilation aspects within office area (d)

3.4. Survey Design

A structured questionnaire is used for the field survey. The questionnaire is based on the attributes and findings from the literature survey. 21 attributes which have a direct impact on the Overall Environmental Satisfaction Level of employees, are identified. Then they

are grouped to the identified four variables described. Accordingly the questionnaire is developed to get the perception of the participants about the office arrangements they are working with.

The questions in the Questionnaire utilizes a Likert-type scale seven responses, ranging from "Very Dissatisfied" (weight = 1) to "Very Satisfied" (weight = 7) for each of the statements. A pilot testing was done among the staff members of Administration Group to ascertain the clarity, simplicity and relevancy. On the views given by them, the questionnaire was modified in some areas.

Floor chart of the field survey is illustrated bellow.

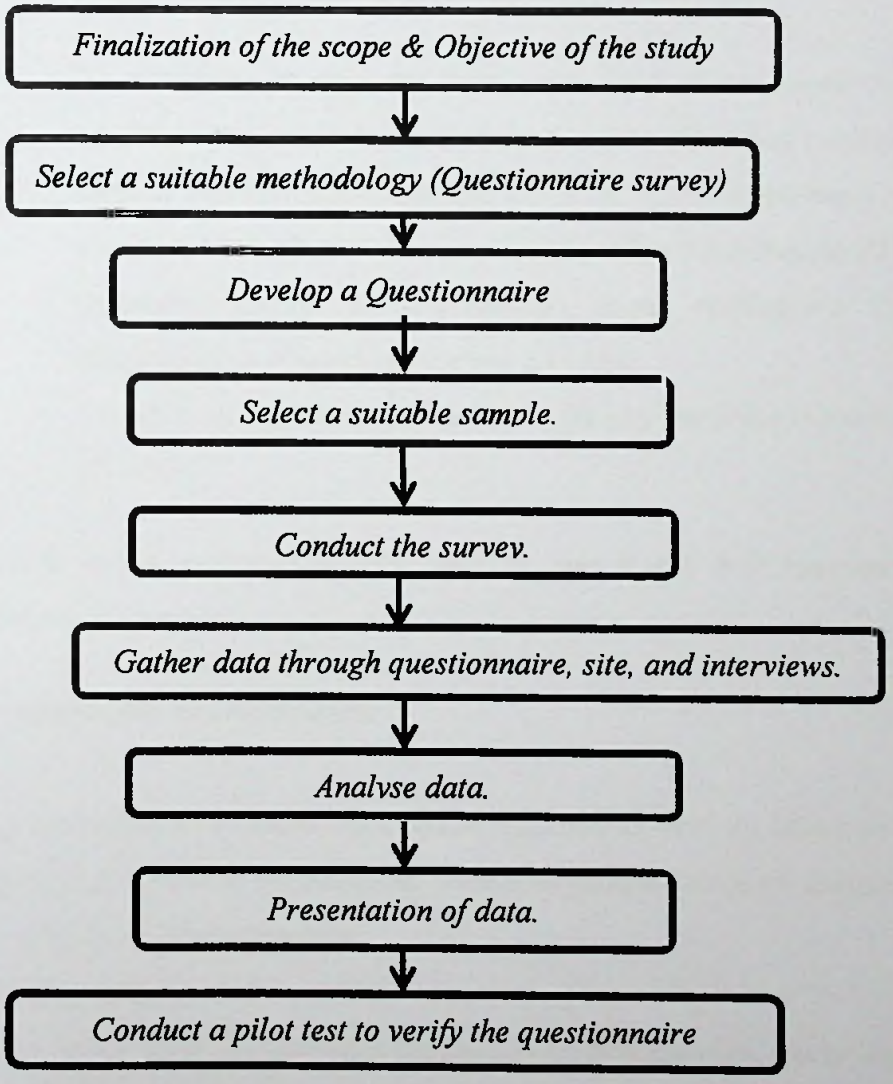


Figure 3.4 : Flow Chart of the Field Survey

The questionnaire was distributed among 46 employees selected. The outputs from the questionnaire were collected for further analysis.

In addition to the above, selected occupants were interviewed to clarify the answers in the questionnaire, get their feedbacks regarding the problems prevail in the layout (other than the commented ones) and their opinions for the improvements for the layouts.

3.5. Measurement of variables

Total number of 21 attributes was identified which were grouped to the 4 key variables. Accordingly a structured questionnaire (**Annexure– I**) was developed to get the satisfaction level of employees in relation to the 4 variables. The structure of the questionnaire is as follows,

* 21 statements to measure satisfaction level of employee in relation to identified attributes - Seven options to select. (Question numbers 1 -21).
* Overall Environmental Satisfaction level of the employee (As a whole) about his work place – Seven options to select (Question no 22).
* Questions to get the information about employee's Demographic characteristics (Question numbers 23 - 26)
* Comments/Suggestion in relation to 04 key variables (Question numbers 27 – 30).

In addition to above temperature, light intensity, wet & dry bulb temperatures of the workstation are measured.

3.5.1. Demographic characteristics

Following demographic characteristics which assumed to have an effect on the Overall Environment Satisfaction of the employee were also gathered from the questionnaire.

1. Gender of the respondent
2. Age group
3. Type of work the occupant engaged in (Administration, Technical, Financial, etc)
4. Highest Educational level of the employee

3.5.2 Seven Option statements (Likert scale response alternatives)

In this technique the occupant is given an opportunity to select a suitable satisfaction level according to the criteria described in the statement. The statements are developed to get the satisfaction level of the employee in – relation to the attributes identified for the key variables identified (ie: - one statement is there for each and every attribute).
The satisfaction level of the employee is weighted as per below.

Optional Statement	Very Unsatisfactory	Un Satisfactory	Little Unsatisfactory	Neutral	Little Satisfactory	Satisfactory	Very Satisfactory
Weight	1	2	3	4	5	6	7

Table 3.1 : Weights allocated for options in the Questionnaire

Accordingly the 21 statements in relation to attributes identified are given bellow.

	Attributes	**Related variable**
a 1.	Disturbance at work station from others noise.	a. Privacy & Noise in your workstation.
a.2.	Disturbance at workstation due to others work.	
a.3.	Support for privacy from nearby furniture, walls etc.	
a.4.	Level of visual privacy in your ws.	
a.5.	Distance between your's and other's ws	
a.6.	Conversational privacy in your ws.	
a.7.	Disturbance from background noises	
a.8.	Additional space allocated for your belongings and for visitors.	
a.9.	Attractiveness of your ws.	
a.10.	Suitability of furniture provided.	
a.11.	Availability of free areas for breaks.	
b.12	How close your team mates are located relative to you	b. Boost for team Work
b.13.	Facilities provided with to have sudden meetings	
b.14.	Availability of meeting rooms, conference rooms.	
b.15.	Facilities provided with to maintain the connectivity with your team mates.	

c.16.	Adequacy of lighting for your ws	c. lighting to the workplace.
c.17.	Adequacy of lighting on your monitor	
c.18.	Disturbance from light reflected from the monitor.	
c.19.	Access to daylight from your ws.	
d.20.	Ability of controlling the temperature of your ws.	d. Ventilation within your ws.
d.21.	Internal air quality of ws	

WS : Work Station

Table 3.2 : Attributes of variables to measure Overall Environmental Satisfaction

3.5.3. Overall Environmental Satisfaction level of the occupant

In this part the occupant is expected to comment on his overall environmental satisfaction level about the working environment he is provided with. Seven - point scale is provided here also to express his satisfaction level.

3.5.4 Comments/Suggestion of occupants, problems they encounter and suggestions for improvements.

In this part, researcher welcomes suggestion or comments from the participants regarding the office environment he is provided with. The occupant is encouraged to comment on problems he encounters with the existing setup, his views about the arrangements as well as improvements suggested for the betterment.

3.6. Conceptual Model of the Study

The relationship between the dependent variable and the 4 independent variables, and the key factors/variables identified conceptualized as follows.

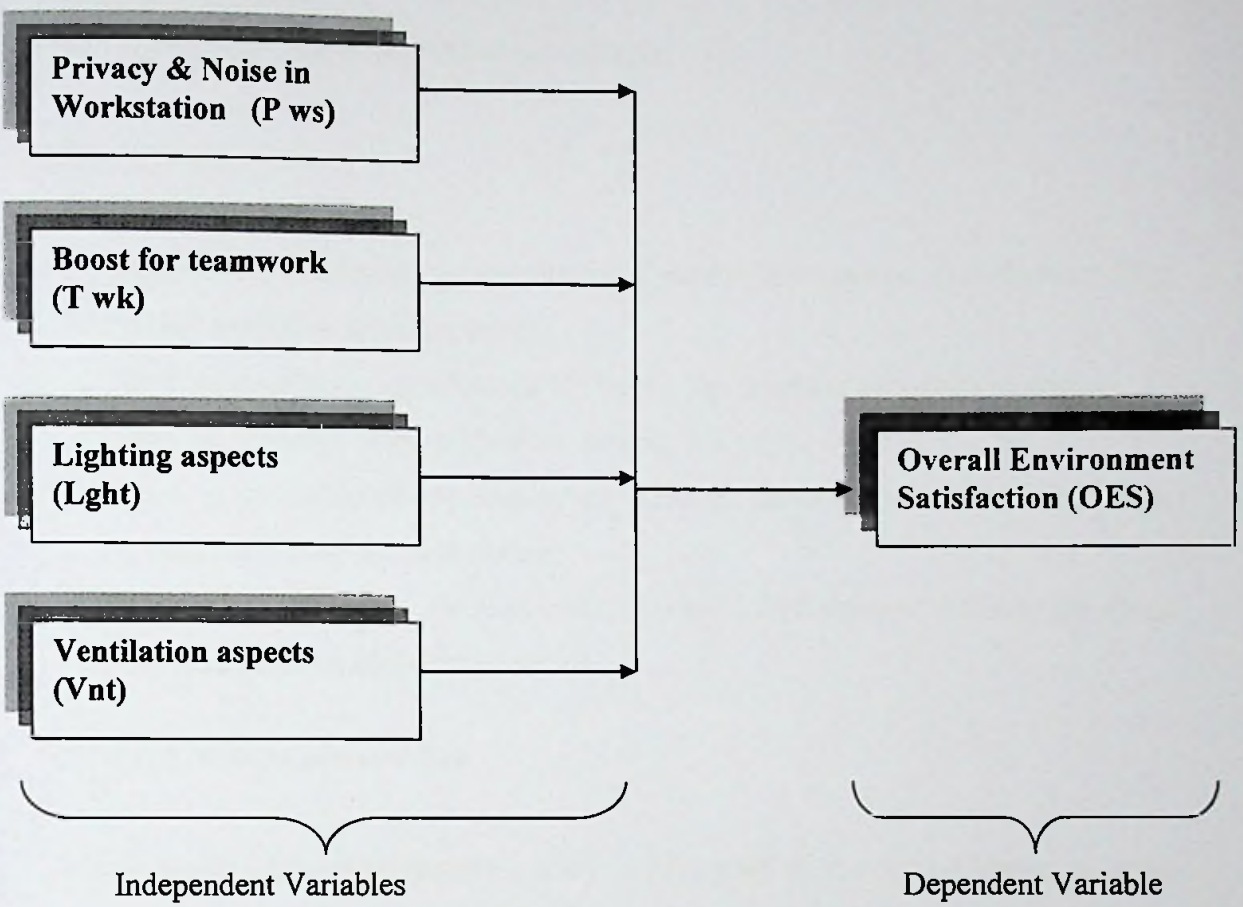


Figure 3.5 : Conceptualization of the study

3.7. Hypothesis Formulation

Following are the statements of hypotheses the researcher wants to test with the help of empirical findings.

Alternative/relevant Hypotheses

H_{1a} : Higher the level of Privacy & work station, higher will be the degree of Overall Environment Satisfaction of the employee.

H_{1b} : Higher the level of boost for teamwork from the work station, higher will be the degree of Overall Environment Satisfaction of the employee.

H_{1c} : Higher the level of Lighting aspects of the work station, higher will be the degree of Overall Environment Satisfaction of the employee.

H_{1d} : Higher the level of ventilation satisfaction of the work station, higher will be the Overall Environmental Satisfaction of the employee.

A Null Hypothesis was also developed accordingly.

Null Hypotheses

H_{0a} : There is no influence on executives' Overall Environment Satisfaction from Privacy aspects in his work station.

H_{0b} : There is no influence on executives' Overall Environment Satisfaction from Boost for the team work in his work station.

H_{0c} : There is no influence on executives' Overall Environment Satisfaction from lighting aspects of the work station.

H_{0d} : There is no influence on executives' Overall Environment Satisfaction from ventilation aspects of the work station.

3.8. Method of Data presentation

The findings form the questionnaire survey is presented in the next Chapter in great detail. Accordingly tables, graphs etc will be used to present the data. Demographic characters in the study are presented using Bar charts, Line charts & Pie charts etc.

3.9. Method of Data Analysis

For the purpose of summarization and analysis of primary data, researcher used MS Excel software package. Descriptive statistics, Regression and Correlation coefficient statistic techniques were used to find the relationship and strength of the relationship of the variables under consideration. The Data analysis tool in Microsoft Excel was used for the purpose.

3.10. Method of Hypothesis Testing

The 'Pearson's correlation coefficient' was used to test hypothesis. In the testing, a significance level of (α) 0.05 was taken at a confidence level of 95%. One-tailed (right-tailed) test is used because H_1 (alternative hypothesis) is concerned with a positive

relationship ($H_1 : P > \alpha$). On the other hand null hypothesis (H_0) is considered as $H_0 : P \leq \alpha$.

3.11. Summary

In this chapter, the Research approach, Research Design, sampling method, Survey design, Conceptualization of the research study, Formulation of hypothesis, methods of data presentation, analyzing the data and testing hypothesis were discussed. As described above the analysis of the primary data collected from the field survey will be done in the next chapter.

CHAPTER IV

DATA ANALYSIS AND PRESENTATION

4.1. Introduction

The data collected from the field survey is analyzed in this chapter. The survey was done in two offices separately and so as the analysis.

There are two types of information available in the data collected from the survey. Data related to demographic characteristics of the executives and data related to executive's working environment are the two types. The demographic characteristics of the executives are presented in tables, charts etc. Further researcher attempts to find any dependence on the Overall Environmental satisfaction with the demographic characteristics.

Secondly the researcher is interested in finding out a relationship between the Executive's Overall Environmental Satisfaction Level with the four dependent variables identified. The developed Hypotheses in relation to above be tested and acceptance or rejection is done accordingly.

In addition to above drawbacks of the Open office layouts and the problems encountered are identified from the comments given by the questionnaire as well as the interviews conducted. Further the expert comments from the senior members within the Facility Management Division were also gathered and analyzed.

4.2. Execution of the Survey

The survey was done in two locations.

1. Survey conducted in Asset Arcade Building- 3rd floor - 15 executives.
2. Survey Conducted in HQ building – 6th floor - 31 executives.

A printed questionnaire was given to the all occupants in a particular office at one time. The paper was collected after completion of the answering. In the meantime the

temperature at the workstation, luminance level, Wet and dry bulb temperatures were measured and recorded.

Having analyzed the questionnaire, selected executives were interviewed for clarification of the given answers, problems they encounter with the open office layout and suggestions for improvement.

The absentees were noted down and the questionnaire was given on a different day with similar climatic conditions and at a similar time.

4.3. Demographics of Executives

Four demographic information of an occupant were collected from the questionnaire and the details collected for all the occupants are summarized below.

	Demographic Characteristic	**Asset Arcade Office (Total 15)**	**HQ – 6th Floor Office (Total 31)**
01	Age Category :- Bellow 30	Nill	Nill
	30 - 39	05	07
	40 - 49	04	15
	50 - 60	06	09
02	Gender :- Male	10	21
	Female	05	10
03	Job specialization :- Admin	02	07
	:- Finance	13	24
	:- Marketing	00	00
	:- HR	00	00
	:- Technical	00	00
04	Educational level :- A/L	02	00
	Diploma	02	09
	Degree	09	14
	Masters	02	08
	PHD	00	00

Table 4.1 : Summery of Demographic data of surveyed Executives

Accordingly the results can be summarized as,

	Characteristic feature	% ge figure Asset Arcade Office (Total 15)	% ge figure HQ – 6th Floor Office (Total 31)
01	Age Category :- Bellow 30	0 %	0 %
	30 - 39	33.3 %	22.6 %
	40 - 49	26.7 %	48.4 %
	50 - 60	40 %	29 %
02	Gender :- Male	66.7 %	67.7 %
	Female	33.3 %	32.3 %
03	Job specialization :- Admin	13.3 %	22.6 %
	:- Finance	86.7 %	77.4 %
	:- Marketing	00	0 %
	:- HR	00	0 %
	:- Technical	00	0 %
04	Educational level :- A/L	13.3 %	0 %
	Diploma	13.3 %	29 %
	Degree	60 %	45.2 %
	Masters	13.3 %	25.8 %
	PHD	00	0 %

Table 4.2 : Composition of Demographic Characteristics (surveyed Executives)

Summarized survey data on demographics are illustrated in the following charts.

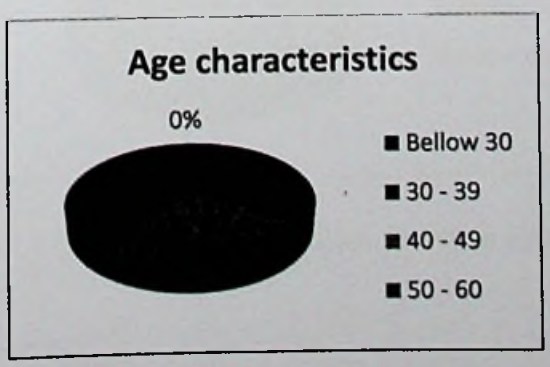


Figure 4.1 : Age characteristics of the Field Survey at Asset Arcade Office

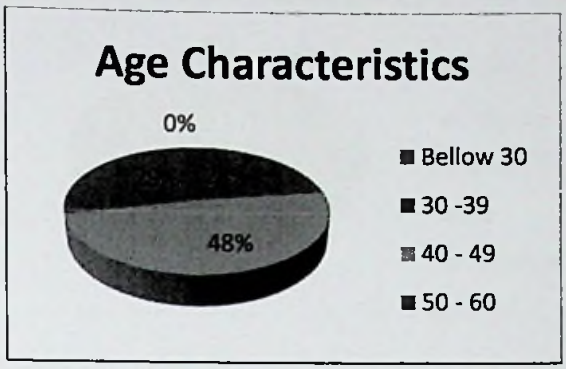


Figure 4.2 : Age characteristics of the Field Survey at HQ – 6th floor

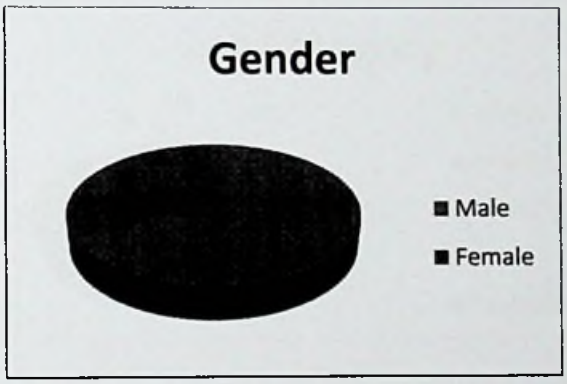


Figure 4.3 : Gender characteristics of the Field Survey at Asset Arcade Office

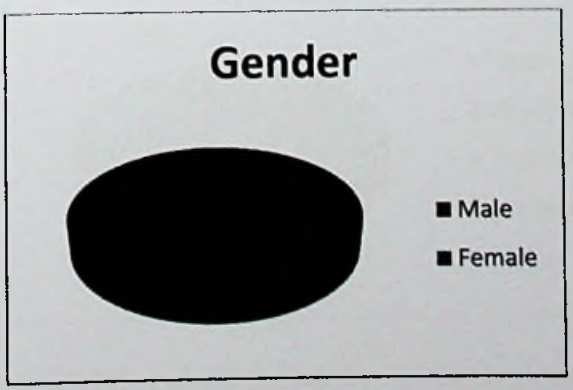


Figure 4.4 : Gender Characteristics of the field survey at HQ – 6th Floor

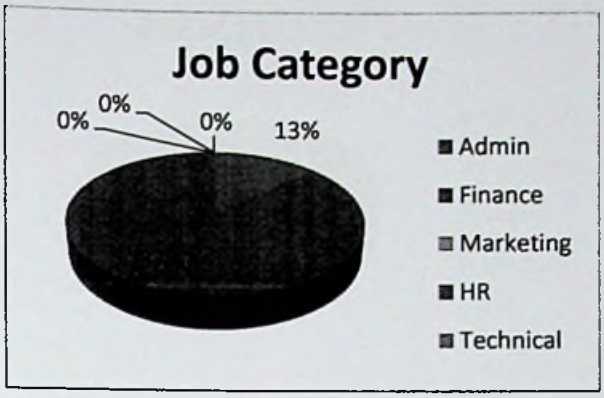


Figure 4.5 : Job Category Characteristics of the field survey in Asst. Arc. Office

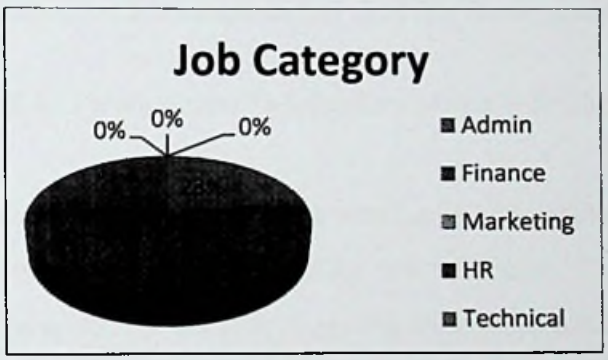


Figure 4.6 : Job Category Characteristics of the field survey in HQ – 6th Floor.

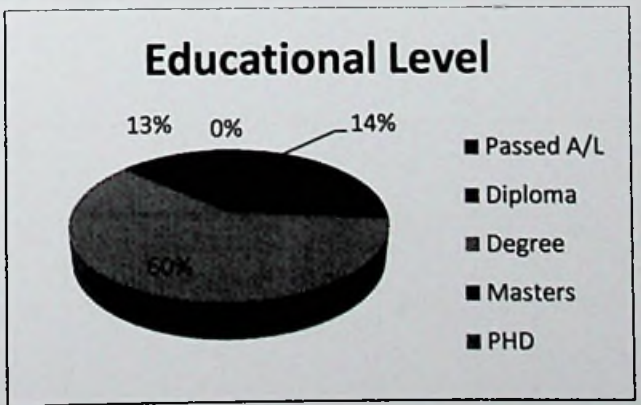


Figure 4.7 : Highest Educational Qualifications of the Occupant; field survey in Asset Arcade Office

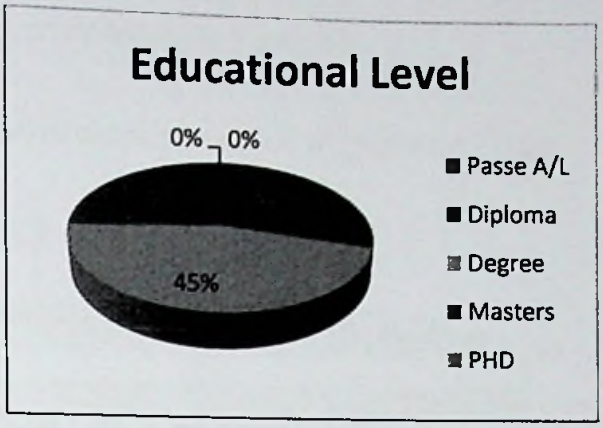


Figure 4.8 : Highest Educational Qualification of the Occupant; Field survey at HQ – 6th Floor.

4.4. Overall Environmental Satisfaction Level of the Occupants

4.4.1 Level of Overall Environmental Satisfaction of the Working Environment.

Here the researcher is interested in finding out overall satisfaction level of each and every executive towards the working environment he/she provided with. The Question no 22 is aiming at the above criteria and the occupant is given with seven options to choose of his satisfaction level. The summery of the responses provided by the occupants in the two offices are summarized and tabulated below.

Deg. of Overall Env. Satisfaction	Very Dissatisfied		Dis-satisfied		Somewhat Dis - satisfied		Neutral		Somewhat Satisfied		Satisfied		Very Satisfied	
Weights assigned	1		2		3		4		5		6		7	
No.of occupants in Asset Arcade	No 01	%ge 6.7%	No 02	%ge 13.3%	No 01	%ge 6.7%	No 05	%ge 33.3%	No 01	%ge 6.7%	No 05	%ge 33.3%	No 0	%ge 0%
No of Occupants in HQ - 6	0	0%	01	3.2%	06	19.4%	03	9.7%	11	35.5%	08	25.8%	02	6.5%

Table 4.3 : Overall Environmental Satisfaction Level of employees %ge wise

The same is graphically presented in the Figure 4.9.

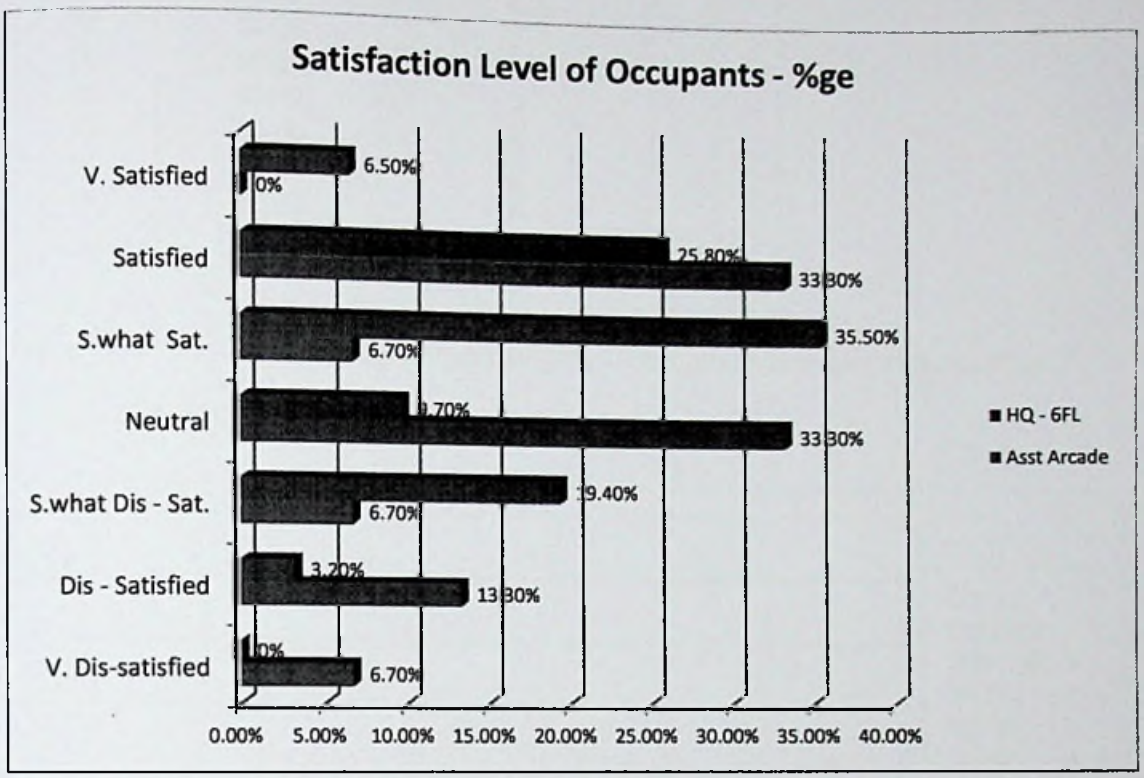


Figure 4.9 : OES of Employees in Asst. Arc. Office and in HQ- 6FL % ge wise.

4.4.2. Relationship between (OES) and Demographic Characteristics studied

Here the researcher is interested in examining the variation of overall environmental satisfaction level with the demographic characteristics surveyed. The data was analyzed using Single factor – Analysis of Variance (ANOVA). Desired significance level, α is taken as 0.05 with a confidence interval of 95 %.

4.4.2.1. Overall Environmental Satisfaction vs. Age Range of Executives

The Overall Environmental Satisfaction (OES) in relation to the age category of the occupants in Asset Arcade office are tabulated bellow.

Occupant	Age Range	Age Range Category	OES
1	40-49	3	6
2	40-49	3	3
3	50-60	4	2
4	30-39	2	1
5	40-49	3	4
6	50-60	4	2
7	40-49	3	4
8	50-60	4	4

Occupant	Age Range	Age Range Category	OES
9	30-39	2	6
10	30-39	2	4
11	50-60	4	4
12	30-39	2	5
13	50-60	4	6
14	30-39	2	6
15	50-60	4	6

Table 4.4 : (OES) vs Age range category - Executives in Asset arcade office.

Accordingly the data is plotted and analyzed

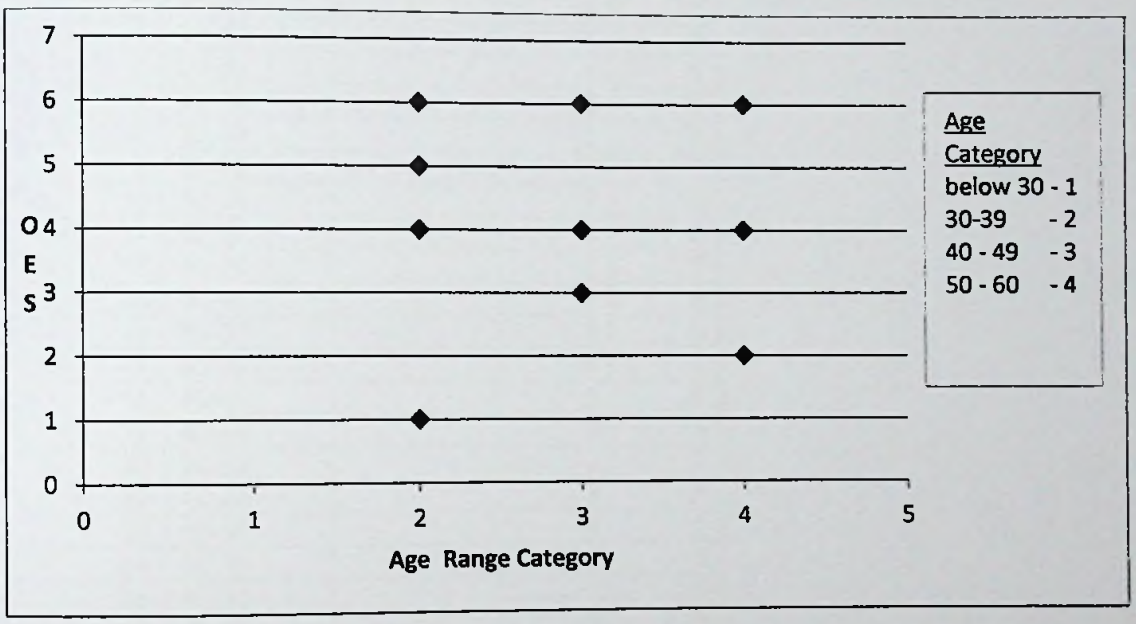


Figure 4.10 : (OES) vs Age range category – Executives in Asst. Arc. Office.

From the Linear Regression Analysis,

R square = 0.0115, Intercept = 4.8171, Satisfaction Coeff. = -0.2012, Std. Error =1.7087

- **Coefficient of Determination**

  Since R square is 0.0115, it is implied that only 1.15% of the variation of Env Satisfaction is explained by Age Category (Variability in predicting satisfaction). Hence it is a Poor linear relationship.

- **Standard Error**

  The value is 1.7087 and indicates that the level of satisfaction may differ by 1.7087 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0 : X1 = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1 : X1 =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis X1 = -0.2012, n=15, Std Error = 0.5168, t stat= -0.3894

  Using 0.05 significance level, n-2=13 ; critical value of t = 2.1604.

Accordingly t stat (= -0.3894) < t critical(= 2.164)

Hence we have to reject H1 and accept H0.

Accordingly a linear relationship between two variables **does not exist.**

Also note that the p value (=0.7033) is not less than anticipated confidence level 0.05.

Accordingly the above conclusion is justified.

The Analysis of OES Vs. Age Category done for HQ – 6FL office is presented below.

Occupant	Age Range	Age Range Category	OES
1	50 -60	4	6
2	50-60	4	5
3	50-60	4	6
4	40- 49	3	6
5	50 -60	4	6
6	50-60	4	5
7	40-49	3	5
8	30-39	2	5
9	30-39	2	3
10	30-39	2	4
11	40-49	3	5
13	40-49	3	7
14	40-49	3	6
16	30-39	2	6
17	50-60	4	5
18	40-49	3	7
19	40-49	3	5
20	30-39	2	3
22	40-49	3	4
23	50-60	4	6
24	40-49	3	5
25	40-49	3	5
26	40-49	3	3
27	40-49	3	4
28	30-39	2	6
29	40-49	3	5
30	50-60	4	5
31	50-60	4	3
32	40-49	3	3
33	40-49	3	2
34	30-39	2	3

Table 4.5 : (OES) vs Age range category – Executives in HQ-6FL Office

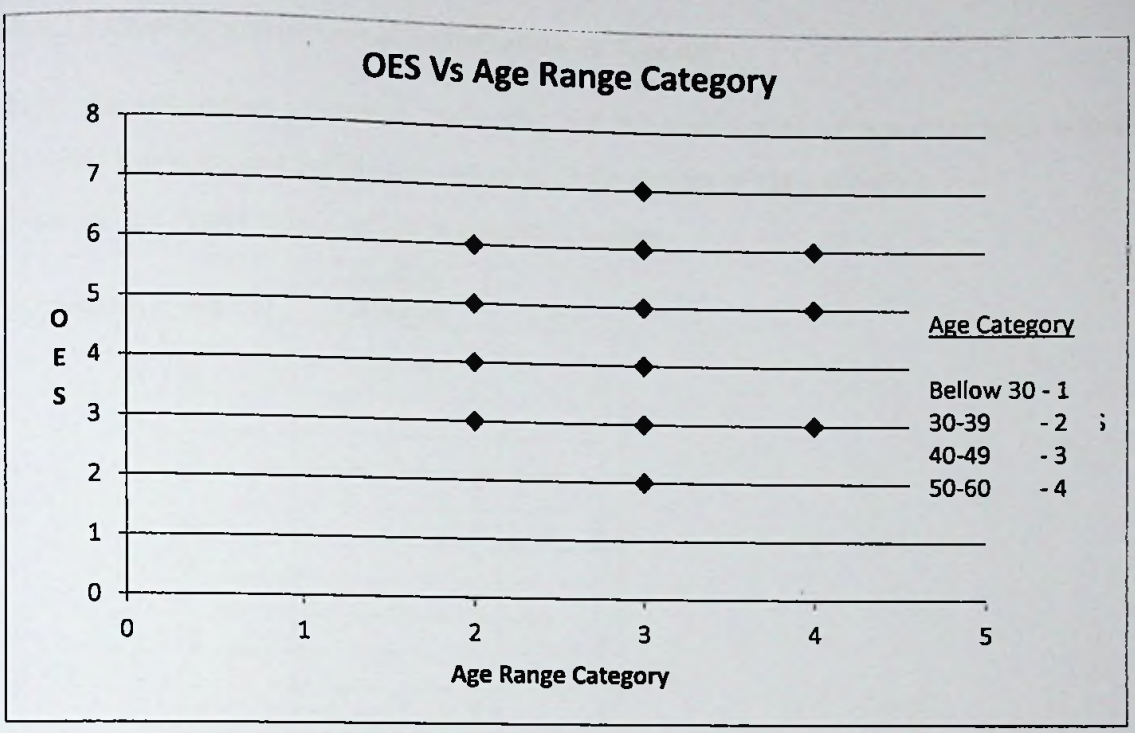


Figure 4.11 : (OES) vs Age range category – Executives in HQ-6FL.

From the Linear Regression Analysis,

R square = 0.0676, Intercept = 3.3801, Satisfaction Coeff. = 0.4654, Std. Error =1.2785

- **Coefficient of Determination**

  Since R square is 0.0676, it is implied that only 6.76% of the variation of Env Satisfaction is explained by Age Category (Variability in predicting satisfaction). Hence it is a Poor linear relationship.

- **Standard Error**

  The value is 1.2785 and indicates that the level of satisfaction may differ by 1.2785 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0 : X1 = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1 : X1 =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis X1 = 0.4654, n=31, Std Error = 0.3209, t stat= 1.4504

  Using 0.05 significance level, n-2=29 ; critical value of t = 2.0452.

  Accordingly t stat (= 1.4504) < t critical(= 2.0452)

  Hence we have to reject H1 and accept H0.

  Accordingly a linear relationship between two variables **does not exist.**

  Also note that the p value (=0.1577) is not less than anticipated confidence level 0.05.

  Accordingly the above conclusion is justified.

4.4.2.2 Overall Environment Satisfaction vs. Gender

Here the researcher interested in finding out the availability of a relationship between Overall Environment Satisfaction level with the gender of the executives.

Data for the Asset arcade office is tabulated below.

Occupant	Gender	Gender Category	OES
1	M	1	6
2	M	1	3
3	M	1	2
4	F	2	1
5	M	1	4
6	M	1	2
7	F	2	4
8	M	1	4
9	F	2	6
10	F	2	4
11	M	1	4
12	M	1	5
13	F	2	6
14	M	1	6
15	M	1	6

Table 4.6 : (OES) vs Gender category – Executives in Asset Arcade Office

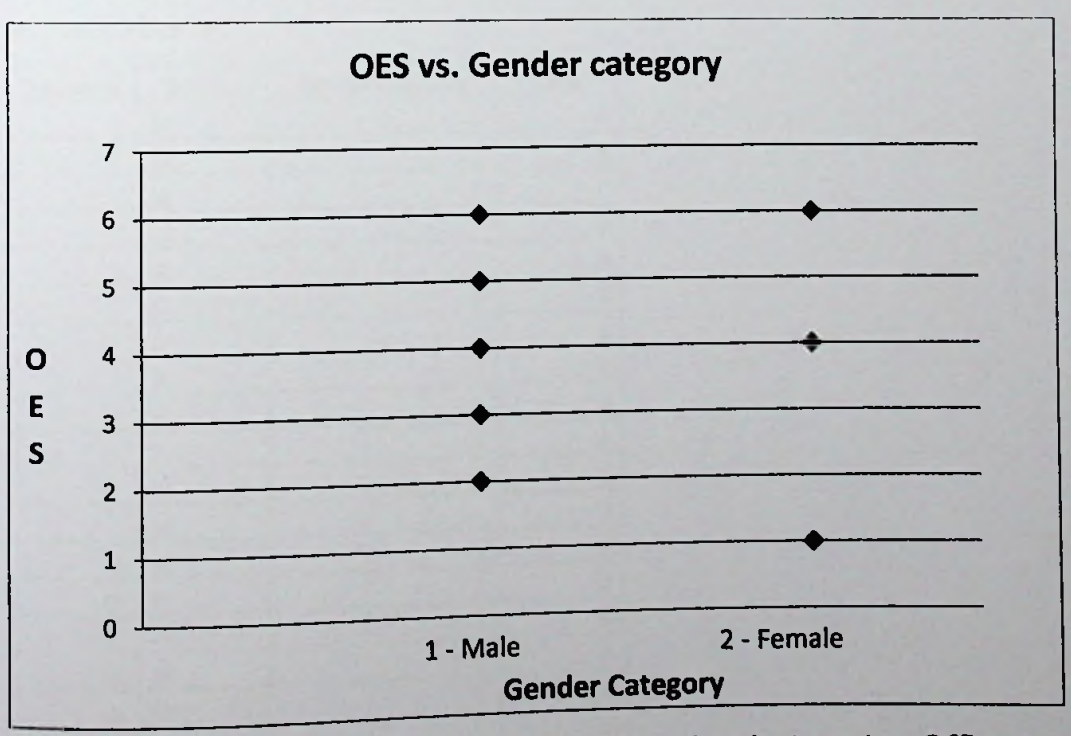


Figure 4.12 : (OES) vs Gender Category – Executives in Asst. Arc. Office

From the Linear Regression Analysis,

R square = 0.0000, Intercept = 4.200, Satisfaction Coeff. = 0.0000, Std. Error =1.7187

- **Coefficient of Determination**

  Since R square is 0.0000, it is implied that hardly any variation of Env Satisfaction is explained by Gender characteristics (Variability in predicting satisfaction). Hence a very poor or no linear relationship exists.

- **Standard Error**

  The value is 1.7187 and indicates that the level of satisfaction may differ by 1.7187 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0 : X2 = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1 : X2 =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis X2 = 0.0000, n=15, Std Error = 0.9414, t stat= 0.0000

  Using 0.05 significance level, n-2=13 ; critical value of t = 2.1604.

  Accordingly t stat (= 0.0000) < t critical(= 2.1604)

  Hence we have to reject H1 and accept H0.

  Accordingly a linear relationship between two variables **does not exist.**

  Also note that the p value (=1.0000) is not less than anticipated confidence level 0.05.

  Accordingly the above conclusion is justified.

Overall Environment satisfaction with gender category of the HQ – 6th Floor office is presented below.

Occupant	Gender	Gender Category	OES
1	M	1	6
2	M	1	5
3	M	1	6
4	M	1	6
5	M	1	6
6	M	1	5
7	M	1	5
8	F	2	5
9	M	1	3
10	F	2	4
11	M	1	5
13	M	1	7
14	M	1	6
16	F	2	6
17	M	1	5
18	M	1	7
19	M	1	5
20	F	2	3
22	M	1	4
23	F	2	6
24	M	1	5

Occupant	Gender	Gender Category	OES
25	M	1	5
26	F	2	3
27	F	2	4
28	F	2	6
29	F	2	5
30	M	1	5
31	M	1	3
32	M	1	3
33	M	1	2
34	F	2	3

Table 4.7 : (OES) vs Gender category – Executives in HQ–6th Floor

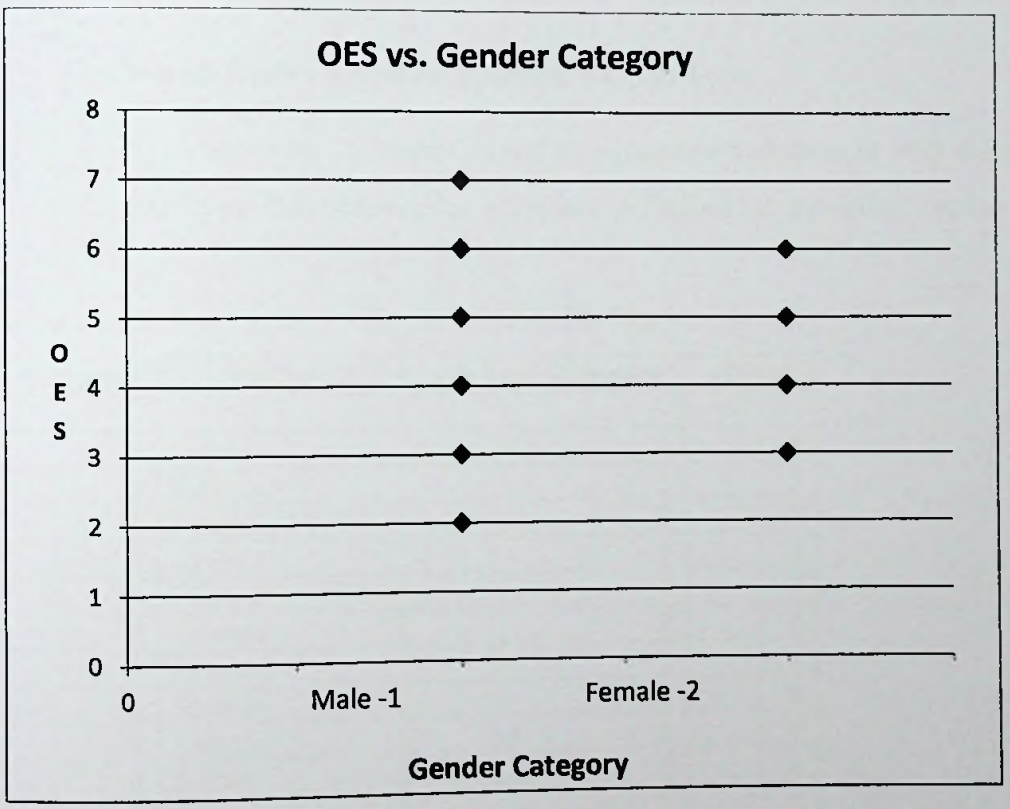


Figure 4.13 : (OES) Vs Gender Category – Executives in HQ-6FL Office

From the Linear Regression Analysis,

R square = 0.0273, Intercept = 5.4048, Satisfaction Coeff. = - 0.4524, Std. Error =1.3059

- **Coefficient of Determination**

  Since R square is 0.0273, it is implied that only 2.73 % variation of Env Satisfaction is explained by Gender characteristics (Variability in predicting satisfaction). Hence very Poor linear relationship exists.

- **Standard Error**

  The value is 1.3059 and indicates that the level of satisfaction may differ by 1.3059 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0 : X2 = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1 : X2 =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis X2 = -0.4524, n=31, Std Error = 0.5017, t stat= -0.9017

  Using 0.05 significance level, n-2=29 ; critical value of t = 2.0452.

  Accordingly t stat (= -0.9017) < t critical(= 2.0452)

  Hence we have to reject H1 and accept H0.

  Accordingly a linear relationship between two variables **does not exist.**

  Also note that the p value (=0.3747) is not less than anticipated confidence level 0.05.

  Accordingly the above conclusion is justified.

4.4.2.3. **Overall Environment Satisfaction Vs. Job Type**

Is there any relationship between Overall Environment Satisfaction with the Job type of the occupant? Now the researcher is interested in finding out a possible relationship.

Data for the Asset arcade office is presented below.

Occupant	Job type	Job Type Category	OES
1	Admin	1	6
2	Finance	2	3
3	Finance	2	2
4	Finance	2	1
5	Finance	2	4
6	Finance	2	2
7	Finance	2	4
8	Finance	2	4
9	Finance	2	6
10	Admin	1	4
11	Finance	2	4
12	Finance	2	5
13	Finance	2	6
14	Finance	2	6
15	Finance	2	6

Table 4.8 : (OES) vs Job type category – Executives in Asset Arcade Office

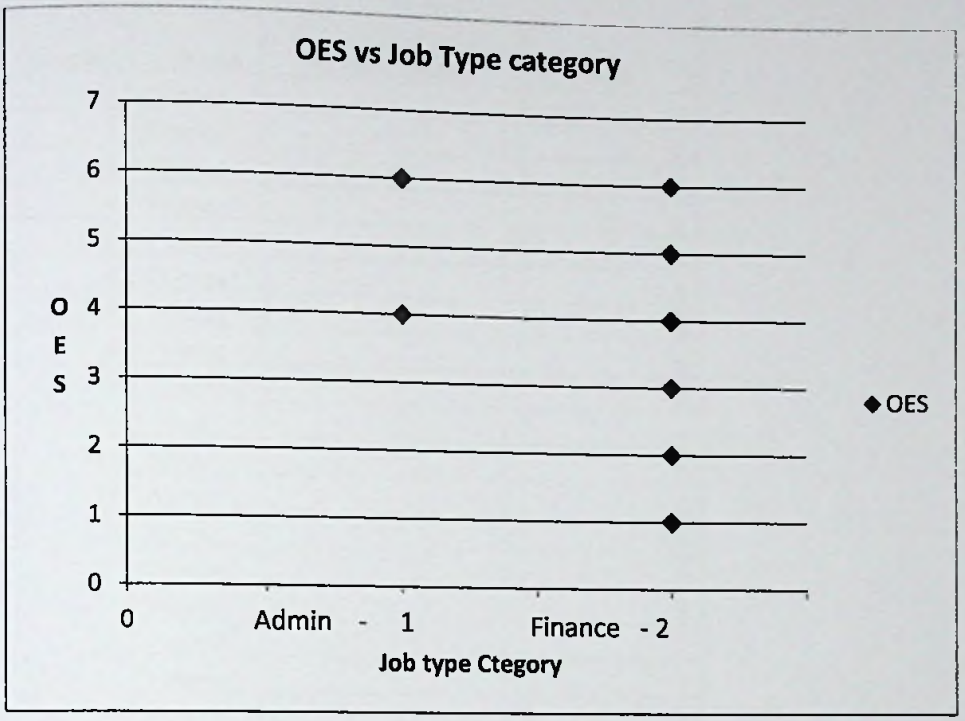


Figure 4.14 : (OES) vs Job Type category – Executives in Asst. Arc. Office.

From the Linear Regression Analysis,

R square = 0.0385, Intercept = 5.9231 Satisfaction Coeff. = - 0.9231, Std. Error =1.6853

- **Coefficient of Determination**

  Since R square is 0.0385, it is implied that only 3.85% of Env Satisfaction is explained by Job type (Variability in predicting satisfaction). Hence very Poor or no linear relationship exists.

- **Standard Error**

  The value is 1.6853 and indicates that the level of satisfaction may differ by 1.6853 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0 : X3 = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1 : X3 =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis X3 = - 0.9231, n=15, Std Error = 1.2801, t stat= -0.7211

  Using 0.05 significance level, n-2=13 ; critical value of t = 2.1604.

  Accordingly t stat (= -0.7211) < t critical(= 2.1604)

  Hence we have to reject H1 and accept H0.

  Accordingly a linear relationship between two variables **does not exist.**

  Also note that the p value (=0.4836) is not less than anticipated confidence level 0.05.

  Accordingly the above conclusion is justified.

Data for the HQ – 6th Floor office is presented below.

Occupant	Job type	Job Type Category	OES
1	Finance	2	6
2	Finance	2	5
3	Finance	2	6
4	Finance	2	6
5	Finance	2	6
6	Finance	2	5
7	Finance	2	5
8	Finance	2	5
9	Finance	2	3
10	Admin	1	4
11	Admin	1	5
13	Admin	1	7
14	Admin	1	6
16	Finance	2	6
17	Finance	2	5
18	Finance	2	7
19	Finance	2	5
20	Finance	2	3
22	Admin	1	4
23	Finance	2	6
24	Finance	2	5
25	Finance	2	5
26	Finance	2	3
27	Finance	2	4
28	Admin	1	6
29	Finance	2	5
30	Finance	2	5
31	Finance	2	3
32	Finance	2	3
33	Finance	2	2
34	Finance	2	3

Table 4.9 : (OES) vs Job type category – Executives in HQ-6th Floor Office

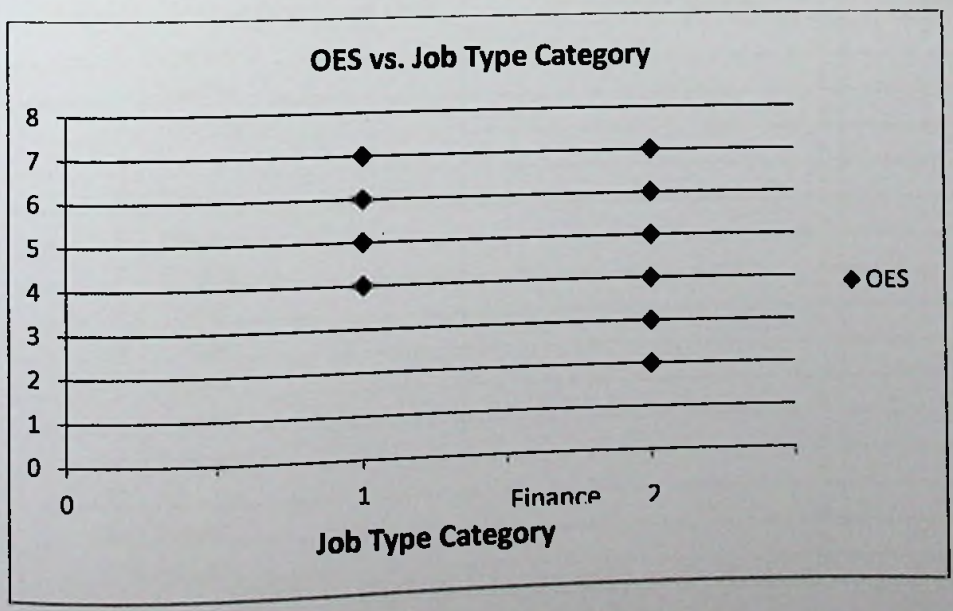


Figure 4.15 : (OES) Vs. Job Type category - Executives in HQ – 6FL Office.

From the Linear Regression Analysis,

R square = 0.0406, Intercept = 5.9867w, Satisfaction Coeff. = - 0.4524, Std. Error =1.2969

- **Coefficient of Determination**

  Since R square is 0.0406, it is implied that only 4.06 % variation of Env Satisfaction is explained by Gender characteristics (Variability in predicting satisfaction). Hence very Poor linear relationship exists.

- **Standard Error**

  The value is 1.2969 and indicates that the level of satisfaction may differ by 1.2969 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0 : X3 = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1 : X3 =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis X3 = -0.6533, n=31, Std Error = 0.5896, t stat= -1.1082

  Using 0.05 significance level, n-2=29 ; critical value of t = 2.0452.

  Accordingly t stat (= -1.1082) < t critical(= 2.0452)

  Hence we have to reject H1 and accept H0.

  Accordingly a linear relationship between two variables **does not exist.**

  Also note that the p value (=0.2769) is not less than anticipated confidence level 0.05.

  Accordingly the above conclusion is justified.

4.4.2.4. **Overall Environment Satisfaction vs. Educational Level of Occupants.**

The researcher tries to find out any possible relationship between the Educational level of the executive and the Overall Environmental satisfaction level.

Data for the Asset arcade office is presented below.

Occupant	Highest Educational Level	Educational Category	OES
1	Degree	3	6
2	Diploma	2	3
3	Post Grad.	4	2
4	A/L	1	1
5	Degree	3	4
6	Degree	3	2
7	Diploma	2	4
8	Degree	3	4
9	Degree	3	6
10	Degree	3	4
11	Degree	3	4
12	Post Grad.	4	5
13	A/L	1	6
14	Degree	3	6
15	Degree	3	6

Table 4.10 : (OES) vs Highest Educational Level – Executives in Asst. Arc. Office

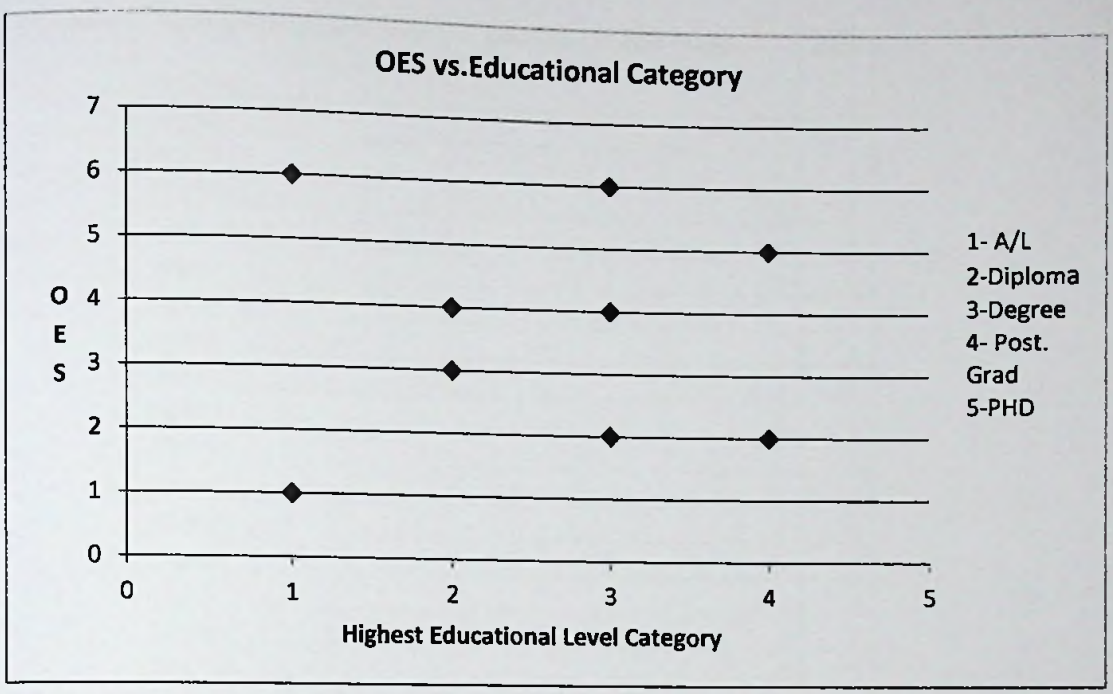


Figure 4.16 : (OES) vs Highest Educational Level – Executives in Asst. Arc. Office.

From the Linear Regression Analysis,

R square = 0.0187, Intercept = 3.5 Satisfaction Coeff. = 0.2561, Std. Error =1.7026

- **Coefficient of Determination**

  Since R square is 0.0187, it is implied that only 1.87% of Env Satisfaction is explained by Job type (Variability in predicting satisfaction). Hence very Poor or no linear relationship exists.

- **Standard Error**

  The value is 1.7026 and indicates that the level of satisfaction may differ by 1.7026 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0 : X4 = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1 : X4 =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis X4 = 0.2561, n=15, Std Error = 0.5149, t stat= 0.4974

  Using 0.05 significance level, n-2=13 ; critical value of t = 2.1604.

  Accordingly t stat (= 0.4974) < t critical(= 2.1604)

  Hence we have to reject H1 and accept H0.

  Accordingly a linear relationship between two variables **does not exist.**

  Also note that the p value (=0.6272) is not less than anticipated confidence level 0.05.

  Accordingly the above conclusion is justified.

Data for the HQ-6th Floor office is presented below.

Occupant	Highest Educational Level	Educational Level Category	OES
1	Post Grad.	4	6
2	Degree	3	5
3	Post Grad.	4	6
4	Post Grad.	4	6
5	Post Grad.	4	6
6	Degree	3	5
7	Degree	3	5
8	Degree	3	5
9	Degree	3	3
10	Diploma	2	4
11	Diploma	2	5
13	Diploma	2	7
14	Diploma	2	6
16	Degree	3	6
17	Degree	3	5
18	Degree	3	7
19	Diploma	2	5
20	Diploma	2	3
22	Diploma	2	4
23	Post Grad.	4	6
24	Diploma	2	5
25	Degree	3	5
26	Degree	3	3
27	Degree	3	4
28	Diploma	2	6
29	Post Grad.	4	5
30	Post Grad.	4	5
31	Post Grad.	4	3
32	Degree	3	3
33	Degree	3	2
34	Degree	3	3

Table 4.11 : (OES) vs Highest Educational Level – Executives in HQ-6FL Office.

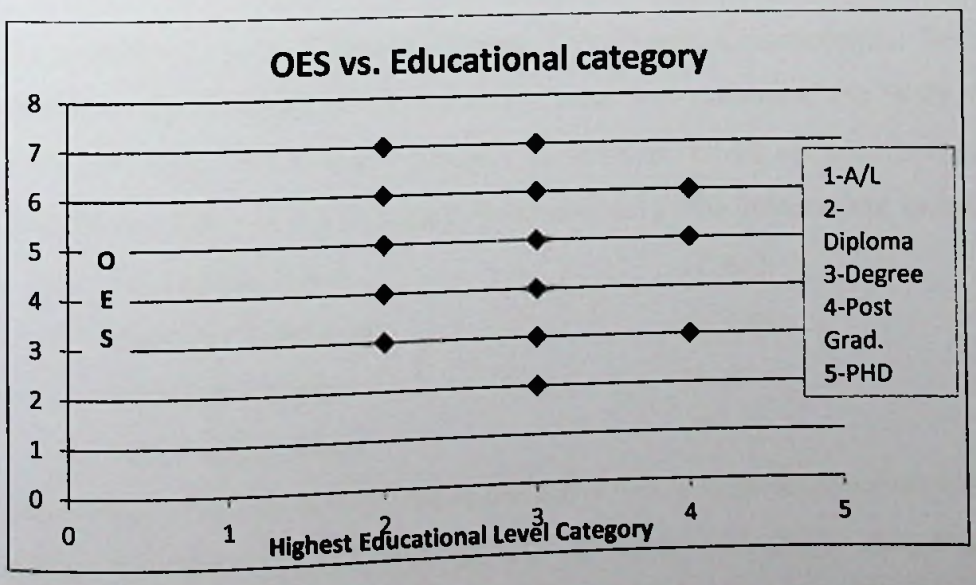


Figure 4.17 : (OES) Vs. Highest Educational Level - Executives in HQ – 6FL Office.

From the Linear Regression Analysis,

R square = 0.0091, Intercept =4.3156, Satisfaction Coeff. = 0.1654, Std. Error =1.3180

- **Coefficient of Determination**

  Since R square is 0.0091, it is implied that only 0.91 % variation of Env Satisfaction is explained by Highets Educational Level characteristics (Variability in predicting satisfaction). Hence very Poor linear relationship exists.

- **Standard Error**

  The value is 1.3180 and indicates that the level of satisfaction may differ by 1.3180 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0: X4 = 0 (There is no Linear Relationship, ie: - Slope is zero).

  H1: X4 =/ 0 (There is a Linear Relationship, ie: - Slope is not zero)

  From results of LR Analysis X4 = 0.1654, n=31, Std Error = 0.3200, t stat= 0.5169

  Using 0.05 significance level, n-2=29; critical value of t = 2.0452.

  Accordingly t stat (= 0.5169) < t critical (= 2.0452)

  Hence we have to reject H1 and accept H0.

  Accordingly a linear relationship between two variables **does not exist.**

  Also note that the p value (=0.6091) is not less than anticipated confidence level 0.05.

  Accordingly the above conclusion is justified.

Accordingly it is observed that none of the Demographic characteristics identified has a relationship with the Overall Environment Satisfaction level of the Occupant in the selected offices.

4.4.3. Analysis for Relationship between Independent variables with OES

As described in the Research Design, The Overall Environmental Satisfaction Level **(OES)** of the Occupant is selected as the Dependent variable of the Study. Following four (04) variables, which were assumed to have an effect on the Overall Environment Satisfaction Level of the Occupant, were selected as the independent variables.

1. Privacy and Noise (P ws).
2. Boost for Teamwork (T wk).
3. Lighting Aspects (L gt).
4. Ventilation Aspects (V nt).

Accordingly the data is analyzed under above four categories separately. Further the two offices (i.e. Asset Arcade Office and HQ – 6th Floor) will also be analyzed separately and the data from the survey summarized and tabulated in **Annexure IV** and **Annexure V.**

4.4.3.1. Overall Environment Satisfaction (OES) vs Privacy & Noise (P ws)

The summarized data is analyzed separately for the two office as below.

Occupant	Privacy & Noise in Workstation (P ws)	Overall Environmental Satisfaction (OES)
1	69	6
2	44	3
3	27	2
4	31	1
5	39	4
6	17	2
7	50	4
8	53	4
9	44	6
10	40	4
11	43	4
12	37	5
13	54	6
14	53	6
15	63	6

Table 4.12 : (OES) vs (P ws) – Executives in Asst. Arc. Office

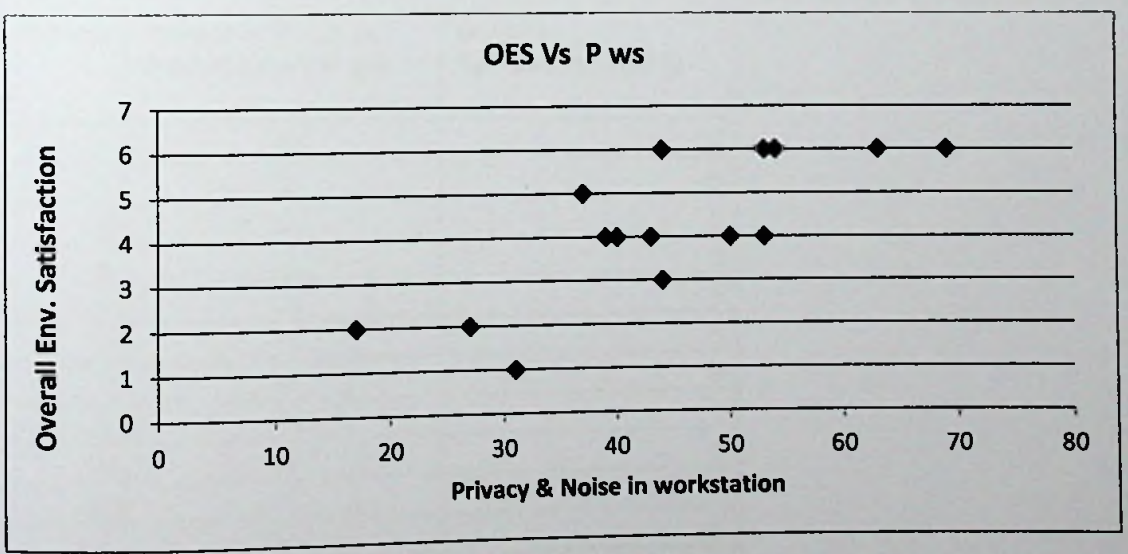


Figure 4.18 : (OES) Vs. (P ws) – Executives in Asst. Arc. Office

From the Linear Regression Analysis,

R square = 0.6114, Intercept = -0.0384 Satisfaction Coeff. = 0.0957, Std. Error =1.071

Hence $Y = -0.384 + 0.0957 X$

- **Coefficient of Determination**

  Since R square is 0.6114, it is implied that 61.14% of Env Satisfaction is explained by Privacy in Workstation (Variability in predicting satisfaction). Hence a very high relationship exists.

- **Standard Error**

  The value is 1.071 and indicates that the level of satisfaction may differ by 1.071 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0a : Xa = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1a : Xa =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis Xa = 0.0957, n=15, Std Error = 0.0212, t stat= 4.5224

  Using 0.05 significance level, n-2=13 ; critical value of t = 2.1604.

  Accordingly t stat (= 4.5224) > t critical(= 2.1604)

  Hence we have to reject H0a and accept H1a.

  Accordingly a linear relationship between two variables **does exist.**

  Also note that the p value (=0.0006) is less than anticipated confidence level 0.05. Accordingly the above conclusion is justified.

Data for the HQ – 6th floor office is presented below.

Person	Privacy & Noise in Workstation (P ws)	Overall Satisfaction (OES)
1	59	6
2	50	5
3	61	6
4	56	6
5	60	6
6	51	5
7	48	5
8	49	5
9	51	3
10	43	4
11	44	5
13	49	7
14	57	6
16	60	6
17	57	5
18	63	7
19	48	5
20	44	3
22	44	4
23	61	6
24	59	5

25	49	5
26	39	3
27	46	4
28	54	6
29	53	5
30	53	5
31	42	3
32	40	3
33	36	2
34	46	3

Table 4.13 · : (OES) vs (P ws) – Executives in HQ – 6FL Office

The result of the analysis is presented in a scatter plot as bellow.

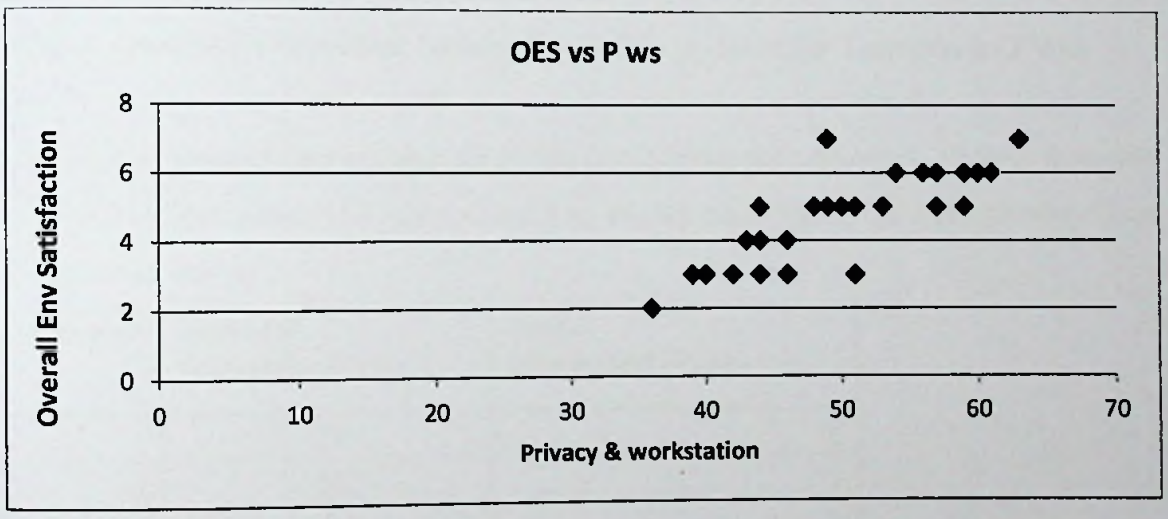


Figure 4.19 : (OES) Vs. (P ws) – Executives in HQ – 6FL Office

From the Linear Regression Analysis,

R square = 0.6540, Intercept = -2.4847, Satisfaction Coeff. = 0.1438, Std. Error =0.7788

Hence, $Y = -2.4847 + 0.1438 X$

- **Coefficient of Determination**

  Since R square is 0.6540, it is implied that 65.40 % variation of Env Satisfaction is explained by Privacy in Work Station characteristics (Variability in predicting satisfaction). Hence very high linear relationship exists.

- **Standard Error**

  The value is 0.7788 and indicates that the level of satisfaction may differ by 0.7787 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0a: Xa = 0 (There is no Linear Relationship, ie: - Slope is zero).

H1a: Xa =/ 0 (There is a Linear Relationship, ie: - Slope is not zero)

From results of LR Analysis Xa = 0.1438, n=31, Std Error = 0.0194, t stat= 7.4045

Using 0.05 significance level, n-2=29; critical value of t = 2.0452.

Accordingly t stat (= 7.4045) < t critical (= 2.0452)

Hence we have to reject H0a and accept H1a.

Accordingly a linear relationship between two variables does exist.

Also note that the p value (=0.0000) is less than anticipated confidence level 0.05. Accordingly the above conclusion is justified.

Accordingly both surveys carried out in the two offices imply that there is a linear relationship between Overall Environment Satisfaction, (OES) and Privacy & noise in Work Station (P ws).

4.4.3.2. Overall Environment Satisfaction (OES) vs Boost for Teamwork (T wk)

The second independent variable identified is the boost for teamwork, (T wk) from the occupant's work place. The summarized data and the analysis for the Asset arcade office is presented below.

Occupant	Boost for Teamwork (T wk)	Overall Satisfaction (OES)
1	27	6
2	20	3
3	9	2
4	7	1
5	15	4
6	13	2
7	22	4
8	18	4
9	23	6
10	20	4
11	17	4
12	22	5
13	22	6
14	25	6
15	22	6

Table 4.14 : (OES) vs (T wk) – Executives in Asst. Arc. Office

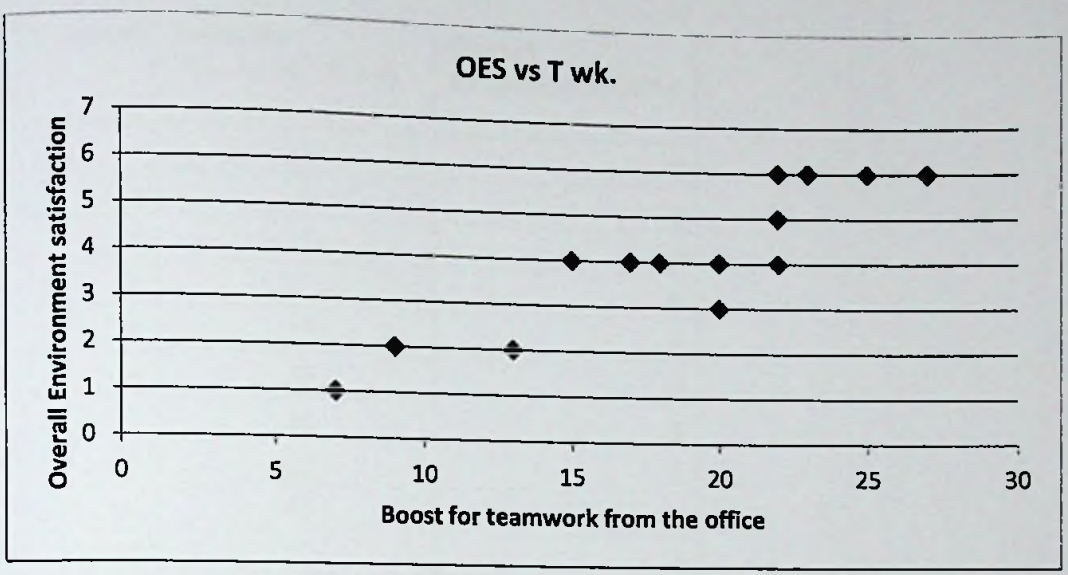


Figure 4.20 : (OES) Vs. (T wk) – Executives in Asset Arcade Office.

From the Linear Regression Analysis,

R square = 0.8061, Intercept = -0.7069 Satisfaction Coeff. = 0.261, Std. Error =0.7568

Hence Y = -0.7069 + 0.261 X

- **Coefficient of Determination**

  Since R square is 0.8061, it is implied that 80.61% of Env Satisfaction is explained by Boost for Teamwork from the Workstation (Variability in predicting satisfaction). Hence very good relationship exists.

- **Standard Error**

  The value is 0.7568 and indicates that the level of satisfaction may differ by 0.7568 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0b : Xb = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1b : Xb =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis Xa = 0.261, n=15, Std Error = 0.0355, t stat= 7.3520

  Using 0.05 significance level, n-2=13 ; critical value of t = 2.1604.

  Accordingly t stat (= 7.3520) > t critical(= 2.1604)

  Hence we have to reject H0b and accept H1b.

  Accordingly a linear relationship between two variables **does exist.**

  Also note that the p value (=0.0000) is less than anticipated confidence level 0.05. Accordingly the above conclusion is justified.

The analysis done for the (OES) against (T wk), with the occupants in HQ- 6th floor is presented below.

Occupant	Boost for Teamwork (T wk)	Overall Satisfaction (OES)
1	21	6
2	18	5
3	21	6
4	21	6
5	22	6
6	20	5
7	20	5
8	20	5
9	13	3
10	17	4
11	19	5
13	25	7
14	23	6
16	21	6
17	19	5
18	26	7
19	21	5
20	16	3
22	17	4
23	22	6
24	19	5
25	20	5
26	14	3
27	18	4
28	22	6
29	22	5
30	19	5
31	12	3
32	9	3
33	9	2
34	13	3

Table 4.15 : (OES) vs (T wk) – Executives in HQ – 6FL Office

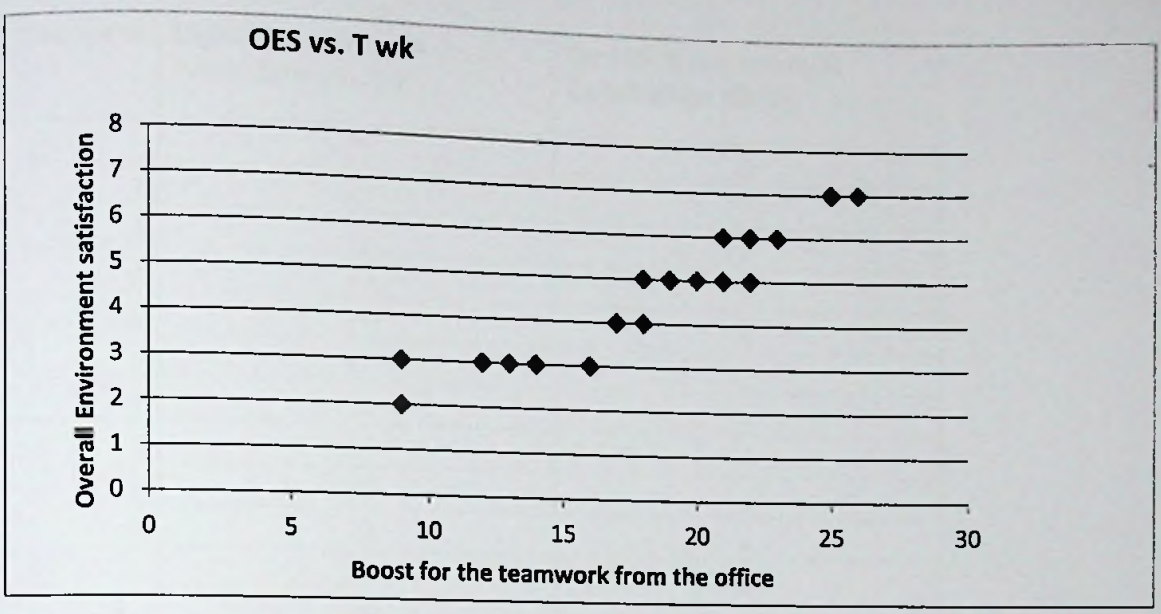


Figure 4.21 - (OES) Vs. (T wk) – Executives in HQ-6FLOffice.

From the Linear Regression Analysis,

R square = 0.8931, Intercept = -0.6979, Satisfaction Coeff. = 0.2947, Std. Error =0.4329

Y = -0.6979 + 0.2947 X

- **Coefficient of Determination**

  Since R square is 0.8931, it is implied that 89.31 % variation of Env Satisfaction is explained by Support to Teamwork from the Work Station (Variability in predicting satisfaction). Hence very good linear relationship exists.

- **Standard Error**

  The value is 0.4329 and indicates that the level of satisfaction may differ by 0.4329 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0b: Xb = 0 (There is no Linear Relationship, ie: - Slope is zero).

  H1b: Xb =/ 0 (There is a Linear Relationship, ie: - Slope is not zero)

  From results of LR Analysis Xb = 0.2947, n=31, Std Error = 0.0189, t stat= 15.5648

  Using 0.05 significance level, n-2=29; critical value of t = 2.0452.

  Accordingly t stat (= 15.5648) < t critical (= 2.0452)

  Hence we have to reject H0b and accept H1b.

  Accordingly a linear relationship between two variables does exist.

  Also note that the p value (=0.0000) is less than anticipated confidence level 0.05. Accordingly the above conclusion is justified.

4.4.3.3. Overall Environment Satisfaction (OES) vs Lighting Aspects (L gt).

The Third independent variable identified is the Lighting aspects,(L gt) within the occupant's work place. Summarized data and the analysis for Asset arcade office are presented below.

Occupant	Lighting aspects on Workstation (L gt)	Overall Environmental Satisfaction (OES)
1	25	6
2	21	3
3	17	2
4	13	1
5	16	4
6	17	2
7	16	4
8	14	4
9	20	6
10	24	4
11	13	4
12	20	5
13	22	6
14	18	6
15	23	6

Table 4.16 : (OES) vs (L gt) – Executives in Asst. Arc. Office

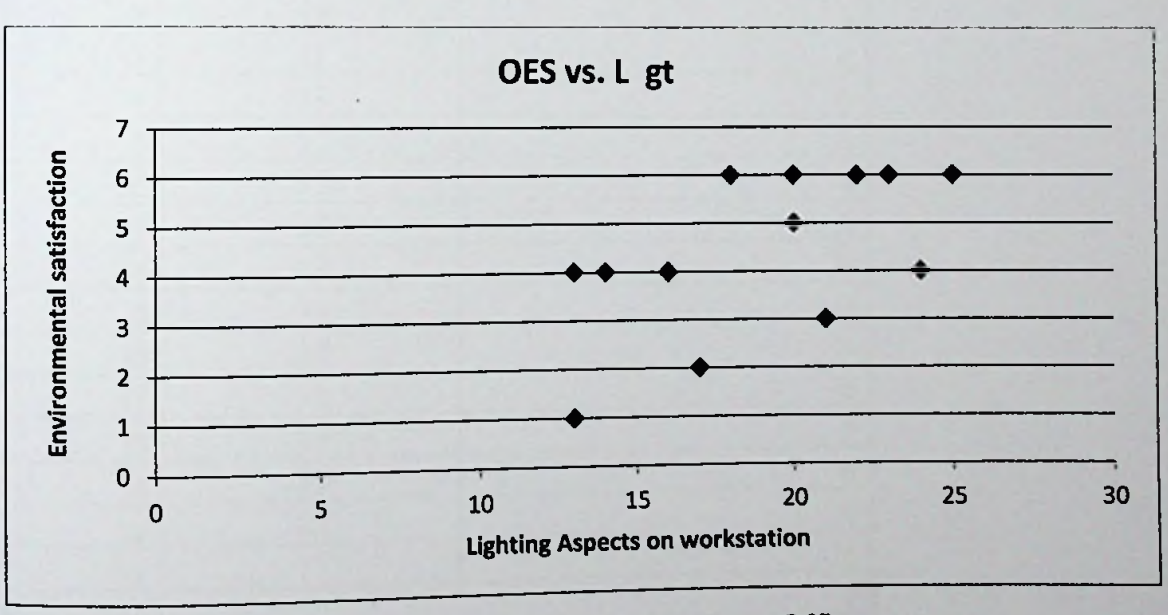


Figure 4.22 : (OES) Vs. (L gt) – Executives in Asst. Arc. Office

From the Linear Regression Analysis,

R square = 0.3322, Intercept = -0.3455 Satisfaction Coeff. = 0.2444, Std. Error =1.4045

Hence $Y = -0.3455 + 0.2444 X$

- **Coefficient of Determination**

  Since R square is 0.3322, it is implied that 33.22% of Env Satisfaction is explained by Lighting Aspects of the work place (Variability in predicting satisfaction). Hence a considerable relationship exists.

- **Standard Error**

  The value is 1.4045 and indicates that the level of satisfaction may differ by 1.4045 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0c : Xc = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1c : Xc =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis Xc = 0.2444, n=15, Std Error = 0.0961 t stat= 2.5431

  Using 0.05 significance level, n-2=13 ; critical value of t = 2.1604.

  Accordingly t stat (= 2.5431) > t critical(= 2.1604)

  Hence we have to reject H0c and accept H1c.

  Accordingly a linear relationship between two variables **does exist.**

  Also note that the p value (=0.0245) is less than anticipated confidence level 0.05. Accordingly the above conclusion is justified.

The summarized data and analysis done for HQ- 6th floor office is presented below.

Occupant	Lighting on Workstation (L gt)	Overall Satisfaction (OES)
1	20	6
2	19	5
3	21	6
4	19	6
5	17	6
6	17	5
7	20	5
8	18	5
9	13	3
10	17	4
11	18	5
13	19	7
14	19	6
16	20	6
17	15	5
18	22	7
19	17	5
20	18	3
22	17	4
23	18	6
24	17	5
25	17	5
26	16	3
27	17	4
28	19	6
29	19	5

30	18	5
31	16	3
32	13	3
33	12	2
34	15	3

Table 4.17 : (OES) vs (L gt) - Executives in HQ – 6FL Office

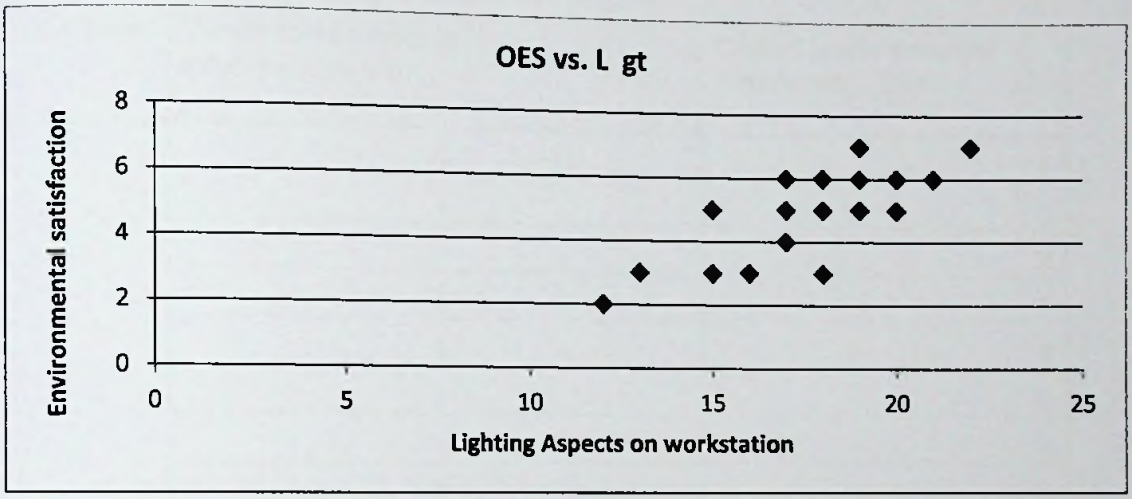


Figure 4.23 : (OES) vs. (L gt) – Executives in HQ-6FL Office

From the Linear Regression Analysis,

R square = 0.6384, Intercept = -3.1897, Satisfaction Coeff. = 0.4565, Std. Error =0.7962

Hence Y = -3.1897 + 0.4565 X

- **Coefficient of Determination**

  Since R square is 0.6384, it is implied that 63.84 % variation of Env Satisfaction is explained by lighting aspects within the work place (Variability in predicting satisfaction). Hence a good linear relationship exists.

- **Standard Error**

  The value is 0.7962 and indicates that the level of satisfaction may differ by 0.7962 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0c: Xc = 0 (There is no Linear Relationship, ie: - Slope is zero).

  H1c: Xc =/ 0 (There is a Linear Relationship, ie: - Slope is not zero)

  From results of LR Analysis Xc = 0.4565, n=31, Std Error = 1.1266, t stat= 7.1555

  Using 0.05 significance level, n-2=29; critical value of t = 2.0452.

  Accordingly t stat (= 7.1555) < t critical (= 2.0452)

  Hence we have to reject H0c and accept H1c.

  Accordingly a linear relationship between two variables does exist.

  Also note that the p value (=0.0000) is less than anticipated confidence level 0.05. Accordingly the above conclusion is justified.

4.4.3.4. Overall Environment Satisfaction (OES) vs Ventilation Aspects within the workstation (V nt).

The Fourth independent variable identified (V nt) is the Ventilation aspects and Air quality within the occupant's work place. The summarized data and the analysis for the Asset arcade office is presented below.

Occupant	Ventilation aspects in Workstation (V nt)	Overall Environmental Satisfaction (OES)
1	8	6
2	4	3
3	5	2
4	3	1
5	4	4
6	2	2
7	11	4
8	6	4
9	6	6
10	6	4
11	4	4
12	3	5
13	9	6
14	5	6
15	9	6

Table 4.18 : (OES) vs (V nt) –Executives in Asst. Arc. Office

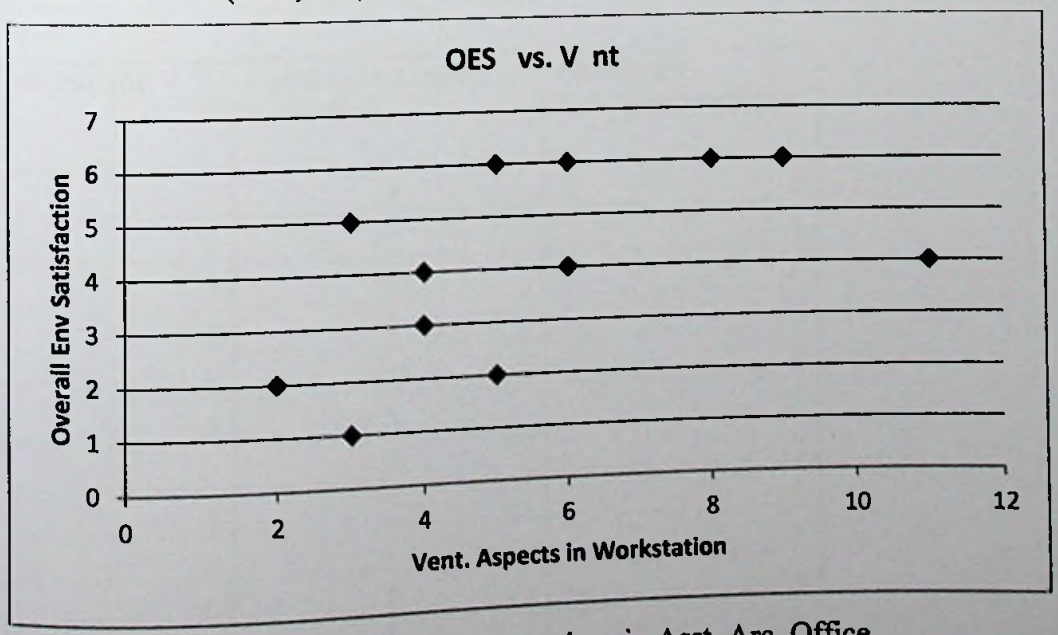


Figure 4.24 : (OES) Vs. (V nt) – Executives in Asst. Arc. Office

From the Linear Regression Analysis,

R square = 0.3039, Intercept = 2.1964 Satisfaction Coeff. = 0.3536, Std. Error =1.4340

Hence $Y = 2.1964 + 0.3536 X$

- **Coefficient of Determination**

  Since R square is 0.3039, it is implied that 30.39% of Env Satisfaction is explained by Air quality and ventilation aspects of the work place (Variability in predicting satisfaction). Hence a considerable relationship exists.

- **Standard Error**

  The value is 1.4340 and indicates that the level of satisfaction may differ by 1.4340 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0d : Xd = 0 (There is no Linear Relationship, ie :- Slope is zero).

  H1d : Xd =/ 0 (There is a Linear Relationship, ie :- Slope is not zero)

  From results of LR Analysis Xd = 0.3536, n=15, Std Error = 0.1484, t stat= 2.3820

  Using 0.05 significance level, n-2=13 ; critical value of t = 2.1604.

  Accordingly t stat (= 2.3820) > t critical(= 2.1604)

  Hence we have to reject H0d and accept H1d.

  Accordingly a linear relationship between two variables does exist.

  Also note that the p value (=0.0332) is less than anticipated confidence level 0.05. Accordingly the above conclusion is justified.

The analysis of the (OES) against (V nt) for the occupants in HQ- 6th floor is presented below.

Occupant	Ventilation Aspects in ws (Vnt)	Overall Env. Satisfaction (OES)
1	9	6
2	9	5
3	10	6
4	9	6
5	10	6
6	5	5
7	5	5
8	7	5
9	4	3
10	5	4
11	6	5
13	7	7

14	7	6
16	7	6
17	6	5
18	8	7
19	7	5
20	7	3
22	7	4
23	7	6
24	7	5
25	7	5
26	8	3
27	8	4
28	6	6
29	6	5
30	8	5
31	6	3
32	5	3
33	3	2
34	5	3

Table 4.19 : (OES) vs (V nt) – Executives in HQ – 6FL Office

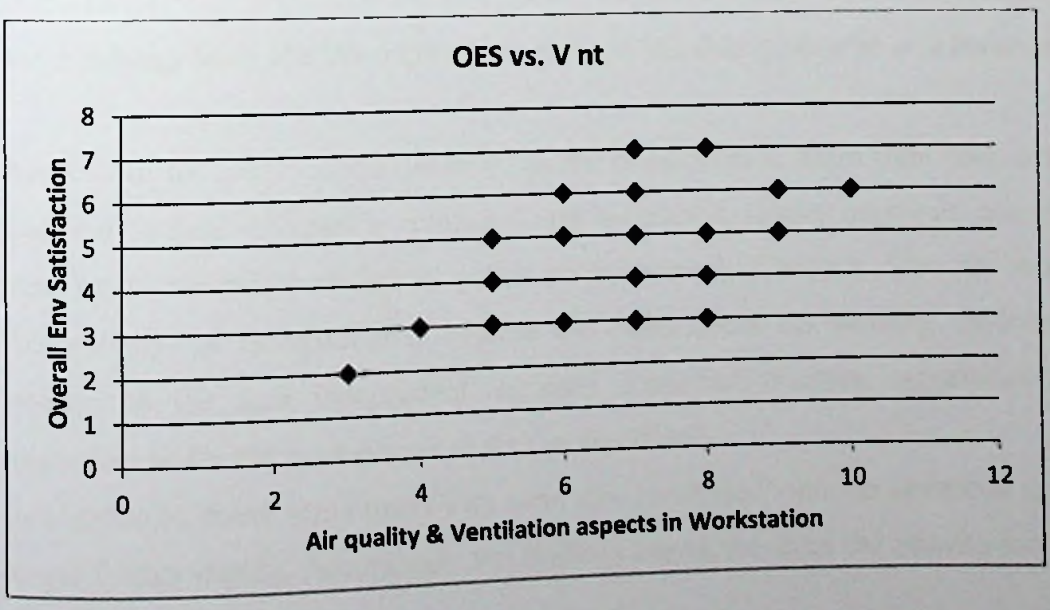


Figure 4.25 : (OES) Vs. (V nt) – Executives in HQ-6FL Office

From the Linear Regression Analysis,

R square = 0.3222, Intercept = 1.7796, Satisfaction Coeff. = 0.4447, Std. Error =1.09
Hence Y = 1.7796 + 0.4447 X

- **Coefficient of Determination**

  Since R square is 0.3222, it is implied that 32.22 % variation of Env Satisfaction is explained by ventilation aspects within the work place (Variability in predicting satisfaction). Hence a considerable linear relationship exists.

- **Standard Error**

  The value is 1.09 and indicates that the level of satisfaction may differ by 1.09 from the predicted line.

- **Testing of Existence of Linear Relationship Between two variables Using "t" test**

  Hypothesis H0d: Xd = 0 (There is no Linear Relationship, ie: - Slope is zero).

  H1d: Xd =/ 0 (There is a Linear Relationship, ie: - Slope is not zero)

  From results of LR Analysis Xd = 0.4447, n=31, Std Error = 0.1198, t stat= 3.7132

  Using 0.05 significance level, n-2=29; critical value of t = 2.0452.

  Accordingly t stat (= 3.7132) < t critical (= 2.0452)

  Hence we have to reject H0d and accept H1d.

  Accordingly a linear relationship between two variables **does exist.**

  Also note that the p value (=0.0009) is less than anticipated confidence level 0.05. Accordingly the above conclusion is justified.

4.5. Findings from the Descriptive questions in the Questionnaire and Interviews.

Apart from the seven option questions in the questionnaire, there were four descriptive questions where occupant's comments are welcomed. These questions are aimed at descriptive answers intended to get more explanatory feedback from the occupants. Accordingly the occupant may express his views about his working environment in relation to the four independent variables identified. Further suggestions for the improvement for the work place can also be described.

In addition to above some interviews were also conducted with the identified executives to get further details. Accordingly the findings abstracted from the above processes are presented below.

	Finding from the Occupants	Justification
01	Not satisfied with the space provided.	# Comparison with earlier occupied space. # Needed more space for keep personnel belongings. # Needed more space to keep previous records. # Needed to accommodate visitors. # Not happy about the common space allocations claiming that they are doing a specialized job.
02	Privacy of the occupants is not addressed in layouts.	# When clustering the subordinates, the adjoining workstation is too close. # In doing so, computer screen, Telephone conversations are seen/heard by nearby staff/outsiders. # Information Security threats.
03	High disturbances in open office layouts	# Occupants are easily disturbed by the activities of the nearby ones as well as surrounding noises.
04	However teamwork is improved.	# Communication between peers is easy in open office layouts.
05	Minimum Facilities to cater for visitors within the office layouts.	# Visitor chairs are provided only for executives and identified ones.
06	Aesthetic appearance of the layouts are good	# Layouts are done in a way that the visual environment is attractive.
07	Loop pile carpeting used in offices may cause health hazards.	# Dust is collected within the carpets and may cause unhealthier situation when breathing the air with dust.
08	Although the blinds which are used for the offices visually pleasing, they tend to damage after a short time period.	# People tend to warp the blinds when they want to see outside from the windows (Whether it is venetian or vertical) without opening it in proper way. Hence the blinds tend to damage.
09	Furniture is aesthetically pleasing and durable.	# However if a part of the furniture is broken, repairing is almost impossible due to various reasons. Need to replace with new furniture.

	Finding from the Occupants	Justification
10	Floor layouts are in-flexible and difficult to adjust with simple variations.	# Occurs specially when left handers are clustered with the right handers. In such situations cable wiring and placing the drawer unit is problematic.
11	The lockers provided are not sufficient to keep the documents as well as personnel belongings.	# People are reluctant to discard the old documents although clear instructions were given on disposal of documents.
12	Within SLT, the parabolic type, fluorescent, 2x2 light fittings are used. Lighting is sufficient.	# Iluminance level on the workplace is satisfactory.
13	Some prefer to adjust the light intensity as per their preferences and is not possible.	# Not possible to change the intensity.
14	Switching off the identified light fittings within an office layout is not possible (sometimes) and is a waste.	# In general two or three light fittings are coupled to one switch. Hence switching off just one fitting is not possible.
15	Some instances, the switches are located at in-proper places.	# There might be instances where, switches of one unit are available in another office and to be avoided.
16	Most of the time natural lighting is not used and is a waste.	# Most of the cases, the windows are covered with blinds and natural lighting is not used.
17	When consider about the Air conditioning arrangements, constant temperature within offices is not maintained	There are areas where low temperatures prevail near to AC machines and high temperature areas away from the ACs.

	Finding from the Occupants	Justification
18	Temperature adjustments as per the user preferences are not possible	Users may not have a chance to adjust the temperature in a centralized AC system at all. Even in an office area where 4 to 5 ACs are fixed, adjustments to one AC unit is not valid.
19	AC environment is vulnerable in spreading air borne diseases.	Air is circulated in the office environment throughout.
20	Threat of increasing the CO_2 level in the office area.	Possibility of mixing inside Air with outside environment is low.

Table 4.20 : Findings from the Descriptive answers and Interviews

4.6. Summary

The data analysis comprised of three main components.

1. Analysis of Demographic characteristics (04) of the occupants for existence of a relationship against the overall environmental satisfaction level.
2. Analysis of four (04) independent variables identified for existence of a relationship against overall environmental satisfaction level.
3. Analyze the data gathered from descriptive questions, interviews held with occupants, interviews held with senior management of FM division to find out difficulties encountered in maintaining Open office layouts and recommendations for the betterment of future work.

Accordingly analysis done on data related to demographic characteristics revealed following.

	Demographic Character	Level of Relationship
01	Age Range Category	No linear relationship exist between (Age Range Category) and (OES)
02	Gender Category	No linear relationship exist between (Gender Category) and (OES).

	Demographic Character	Level of Relationship
03	Job Type Category	No linear relationship exist between (Job Type Category) and (OES).
04	Highest Educational Level	No Linear relationship exist between (Highest Educational Level) and (OES)

Table 4.21 : Relationship Summery for Demographic Characteristics

Secondly, 21 attributes which are related to 4 identified independent variables were analyzed against the Overall Environmental Satisfaction level the executives for existence of a linear relationship. Accordingly the results of the study are summarized below.

	Independent Variable	Level of Relationship
01	Privacy & Workstation (P ws)	Good Linear Relationship exists.
02	Boost for Team work (T wk)	Good Linear Relationship exists.
03	Lighting Aspects (Light)	Moderate Relationship exists.
04	Ventilation aspects (Vnt)	Poor Relationship exists.

Table 4.22 : Relationship summery for independent variables

Finally the data gathered form interviews were grouped and summarized and findings were tabulated in Table 4.20.

Results described above are discussed for accuracy and validity using the available literature in the next chapter and conclusion as well as recommendations will be provided.

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		ඉතා අසතුටු දායකයි	අසතුටු දායකයි	ස්වල්පව අසතුටු දායකයි	මධ්‍යස්ථයි	ස්වල්පව සතුටු දායකයි	සතුටු දායකයි	ඉතා සතුටු දායකයි	
1	වැඩ ස්ථානයේදී අන් අයගේ කථාබහ ඔබගේ වැඩට බලපාන ආකාරය								වැඩ ස්ථානයේ වාතාවරණය හා එහි ඔබගේ පෞද්ගලිකත්වය
2	දිනකදී අන්අයගේ කටයුතු මාගේ වැඩවලට අහිතකර ලෙස බලපාන වාර ගණන								
3	අවට ඇති බිත්ති, ගෘහභාණ්ඩ ආදිය මගින් වැඩ ස්ථානය ආවරණය වීම තුළ මාගේ පෞද්ගලිකත්වය ආරක්ෂා වී ඇති ප්‍රමාණය								
4	වැඩ ස්ථානයේ දෘශ්‍ය පෞද්ගලිකත්වය ආරක්ෂාවී ඇති ප්‍රමාණය								
5	ඔබත්, ඔබ අසල ඇති අන් අයගේ වැඩ ස්ථානත් අතර පරතරය								
6	වැඩ ස්ථානය තුල සුරක්ෂිතව සාකච්ඡා කිරීමේ හැකියාව								
7	වටපිටාවේ ශබ්ද, නිසා ඔබගේ වැඩකටයුතු වලට සිදුවන බාධාවීම් වල ස්වභාවය								
8	වැඩ ස්ථානයේ රාජකාරී සටහන් වලට, පෞද්ගලික බහුබාහිරාදිය හඬා ගැනීමට, අමුත්තන් සඳහා ඉඩ පහසුකම් සලසා ඇති ප්‍රමාණය								
9	වැඩ ස්ථානයේ සිත්ගන්නා සුළු ප්‍රමාණය								
10	සපයා ඇති ගෘහභාණ්ඩ වල ස්වභාවය								
11	වැඩ කරන අතරතුර විඩා නිවා ගැනීමට නිදහස් ස්ථාන සපයා ඇති ප්‍රමාණය								
12	ඔබ කණ්ඩායමේ අනෙකුත් සාමාජිකයින් (උසස්, සම, පහළ නිලධාරීන්) ඔබට ආසන්නව ස්ථාන ගතකර තිබීම								කණ්ඩායම් සම්බන්ධීකරණයට වැඩ ස්ථානයේ පවතින පහසුකම්
13	කණ්ඩායම් සාමාජිකයින් සමග හදිසි සාකච්ඡාවන් පැවැත්වීමට සලසා ඇති පහසුකම්								
14	කාර්යාලය තුල සාකච්ඡා කටයුතු සඳහා කාමර පහසුකම් තිබීම								
15	කණ්ඩායමේ සම්බන්ධතාවයන් පැවැත්වීමට සලසා ඇති පහසුකම්								
16	වැඩ ස්ථානයට ලැබෙන ආලෝකයේ ප්‍රමාණවත් බව								වැඩ ස්ථානයට ලැබෙන ආලෝකය
17	පරිගණක තිරය මතට වැටෙන ආලෝකයේ ප්‍රමාණවත් බව								
18	පරිගණක තිරයෙන් වන පරාවර්තනය මගින් බාධාවීම්								
19	නිදහස් සූර්යාලෝකය වෙතට පහසුවෙන් යාමට ඇති හැකියාව								
20	වැඩ ස්ථානයේ උෂ්ණත්වය පාලනය කිරීමට ඇති හැකියාව								වැඩ ස්ථානයේ වාතාශ්‍රය
21	වැඩ ස්ථානයේ වාතාශ්‍රය සතුටුදායකද?								
22	සමස්ථයක් ලෙස ඔබගේ වැඩස්ථානයේ සාර්ථකත්වය පිළිබඳ, ඔබගේ හැඟීම								

		පුරුෂ	ස්ත්‍රී			
25	රාජකාරී ස්වභාවය	පරිපාලන	තාක්ෂණික	මූදල්මය	වෙළඳ	මානව සම්පත්
26	උසස්ම අධ්‍යාපනික සුදුසුකම	උ/පෙළ	ඩිප්ලෝමා	උපාධි	පශ්චාත් උපාධි	ආචාර්ය

27 වැඩස්ථානයේ පහසුකම් හා එහි ඔබගේ පෞද්ගලිකත්වය පිළිබඳව අදහස් හා යෝජනා.

28 වැඩස්ථානයේ පහසුකම් හා ස්වභාවය කණ්ඩායමක් ලෙස කටයුතු කිරීම පහසු කරයිද? යන්න ගැන ඔබගේ අදහස් හා යෝජනා.

29 වැඩ ස්ථානයේ ආලෝක ස්වභාවය ප්‍රමාණවත් භාවය පිළිබඳ අදහස් හා යෝජනා.

30 වැඩස්ථානය තුල වාතාශ්‍රය පිළිබඳ ඔබගේ අදහස් හා යෝජනා.

නම හා තනතුර දිනය අත්සන

උෂ්ණත්වය
ආර්ද්‍රතාවය
ආලෝක ප්‍රමාණය

Annexure II :- Discussion with DGM/Environment

Open Office Layouts : ***Their Impact for the employees, Problems encountered and Suggestions for Improvement***

Discussion with :- Mr. K.N. Weerakkon (C. Eng, MIESL) , DGM/Env, SLT

Date :- 11th May 2015.

Location :- DGM/Env office, 2nd Floor , CTO Building, SLT-HQ, Colombo 01.

Aim of Discussion :- 1. No.of concerns were highlighted by the executives participated for the questionnaire in HQ-6th Floor, 3FL- Asset arcade building. Accordingly it is required to verify their concerns with an experience personality of the subject.

2. Identify the problems encountered with executing the Open Office arrangements in SLT.

3. Identify possible recommendations for betterment of Open office Layouts in future.

Following are the highlights of the Discussion with Mr. K. Weerakoon, DGM/Env.

1. **Open Office Layouts in SLT.**
    - Office space within SLT-HQ and Colombo Metro area is very scarce resource and hence a prime concern in SLT.
    - Meantime regular changes in the organization structure are a common aspect in SLT.
    - Accordingly Open office arrangements were introduced and adopted over the past decade within SLT to cater the requirements of the higher management and the requirements and needs of the employees.

2. **Collecting required information from the users**
    - Planning is the key for success or a failure for office layout also.

- Hence to design a proper and user friendly layout, gathering of necessary data relevant to user requirements and their inter-dependencies within office is very important.
- Proper requirements are communicated at the very first instance of gathering data. Often users are not clear about what they need. However it is the duty of the FM team member to dig the actual requirements of the user through a fruitful discussion.
- On the other hand so many inter-dependencies may exist within workstations inside an office. Such dependencies are to be carefully studied and catered for in designing office layouts.

3. **Verification of the Proposals**
   - User department verification for the proposal is a must in developing a proposal for office layout.
   - This should be done at several stage and the concerns from the User Department has to be accounted for the proposal. The final proposal too to be verified and confirmed by the User department before implementation.

4. **Space allocation and Occupants Satisfaction.**

   - Most of the time occupants are not satisfied with the space they are allocated with.
   - Exact reasons for their dis-satisfaction are not clear. But the untold, possible reasons are as follows.
     * Always compare with the space allocated for them several years back.
     * Not align with company objectives.
     *People feel that the space is an expression of his status core.
     *Reluctant to dispose the un-necessary documents. (Although a circular is issued).

5. **Privacy for an Occupant in Open Office Layout.**
   - Executives are not placed in cluster arrangements. However FM promotes clustering the non-executives where ever possible.
   - However occupants oppose clustering arrangements providing no.of reasons. Threat for information security, working on the computer screen is visible to others, Telephone conversations are heard by the others are few of them.
   - The said concerns are debatable considering following.
     # In designing office layouts, outsiders are always discouraged to enter into the non-executive workstations.

If meeting of visitors is a business requirement, particular occupant will be given with visitor chairs and will be separated from clustering arrangements. However a justification should be there from his/her superior.
On the other hand, if the occupants require to meet visitors regularly, a separate customer area outside the office space will be provided with the recommendation of the relevant chief officer.
Hence only the team mates of the cluster can see the workings of an occupant or can hear a conversation. Hence it is not an information security threat.

6. **Disturbance from surroundings.**
   - Maximum possible measures will be taken to prevent / minimize surrounding noise, unwanted light etc, when designing and implementing office layouts.

7. **Disturbance from Piers / Team mates**
   - Self-discipline within team mates to be maintained to minimize the disturbances, because provisioning of separate cubicles to everybody is not practicable.

8. **Improved Team work in Open Office Layouts**
   - In an open office layouts most of the members of the team are located close by. Hence the problems can be discussed freely at any time and the cohesiveness of the team will improve accordingly.
   - However care should be taken if a left hander is occupying a position in the cluster.

9. **Proper analysis of customer requirements – key to success of the layout.**
   - Prior to design the layouts, it is very vital to understand the requirements and needs of the users and their interdependencies. Hence a proper analysis and verification from the user department is a must.

10. **Flexibility of the layout**
    - Open office layouts are always flexible than the cellular layouts. Flexibility of the layout is higher when it is considered in civil and power perspective. However it is not so when considered about data and AC arrangements.

11. **Lighting arrangements**
    - Lighting arrangements within SLT are acceptable to the requirements. No mechanisms to adjust the light intensities as per the preference of users, switching off the unwanted lights when required (due to coupling several lights to one switch) are some drawbacks exist within the arrangements. The FM team always

tries to accommodate natural lighting to the office layouts where ever possible. However glare on computer screens is a major challenge.

12. AC Arrangements

- Most occasions, existing spaces are converted to new office arrangements which are not intentionally designed for the purpose. This is true even for rented out premises also. We the SLT, hardly construct buildings to cater the requirements like developing office spaces.
- Accordingly office spaces may contain barriers to proper AC flow (eg :- height restrictions, isolated or covered areas etc). In such situations traditional design may not suited. The AC system has to be designed considering all of those details etc.
- In such situations several no. of small capacity AC's are preferred rather than the limited no. of high capacity machines although it may affect the power consumption.

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DGM/Env

RANCHANA WEERAKOON
DGM / Environment
Facility Management Division
Sri Lanka Telecom PLC

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V.D. Geekiyanage

Annexure III – Discussion with GM/FM

Open Office Layouts : *Their Impact for the employees, Problems encountered and Suggestions for Improvement*

Discussion with :- Mr. J. A. M. Wijerathna (C. Eng, MIESL) , GM/FM, SLT

Date :- 15th May 2015.

Location :- GM/FM office, 2nd Floor , CTO Building, SLT-HQ, Colombo 01.

Aim of Discussion :- 1. No.of concerns were highlighted by the executives participated for the questionnaire in HQ-6th Floor, 3FL- Asset arcade building. Accordingly it is required to verify their concerns with an experience personality of the subject.

2. Identify the problems encountered with executing the Open Office arrangements in SLT.

3. Identify possible recommendations for betterment of Open office Layouts in future.

Following are the highlights of the Discussion with Mr. J. A. M. Wijerathna, GM/FM.

1. **Space a Key Resource within SLT.**

   - Office space within SLT – HQ and Colombo metro area is identified as one of the most scarce and valuable resource. Hence the space has to be manage with special care considering the business requirements of the organization while fulfilling the requirements and needs of the employees.
   - Having identified the importance of space a circular has already been published standardizing the work space allocation of the offices.
   - Deviations from the allocations provided in the circular to be approved by the CAO on recommendations of the relevant Chief Officer.

2. **Gathering correct information; a major problem**

   - Collecting the required information prior to design is the most important aspect of developing office arrangements. The actual requirements of the User department as well as the interdependencies within the office are to be clearly identified prior

to design. The same are to be catered very carefully for the effectiveness and success of an office layout.

- It is experienced that the proper requirements are not communicated due to various reasons. Hiding the actual requirements purposely, visualization problems of the layouts, difficulties in forecasting the actual requirements are some important reasons.

3. **Change requirements, a major issue.**

- Change requirements once the proposal is finalized are the most common and biggest problem encountered by FM division.
- However this to be minimized as far as possible since it will incur additional cost as well as delays to the total project which is sometimes unbearable.
- It is always encourage including few members from the User department for the design phase. Comments of theses members are always encouraged and attempts are to be made to cater such fare comments where ever possible. On the other hand such members will be the communicators towards the User department about the proposal in the pipeline. Accordingly the needs of the others of the User department can also be included through them.

4. **User awareness sessions on handing over.**

- It is experienced that the office elements are not utilized as planned while in operation. Adjusting temperature levels in ACs in improper manner, improper practices in opening and closing window blinds, improper usage of toilet fittings and theft are some common examples.
- Accordingly user awareness sessions regarding the operating methods as well as the intended designing aspects, required operational levels of the equipment, maintenance procedures are always encouraged prior to handover.

5. **Higher Flexibility is always better.**

- Changes to the organizational structure and hence the office layouts are unavoidable and frequent in today's context.
- Changes to the office layouts are always incorporated with cost and time delays.
- If the office layouts are incorporated with easy to dismantle and easy to assemble materials, there is always a cost saving and time saving to the organization. Hence such elements are to be incorporated with office designs where ever possible.

6. Verification of Operational performance of Offices.

- The office layouts are designed upon certain assumptions and operational efficiencies of the equipment fixed.
- May at the time of handing over, the operational levels of the office and its components are as intended. However this may not be the case after certain time period.
- In such situations, the occupants might not be at their comfort levels as intended. Hence it is always better to verify the operational levels of the offices time to time and relevant remedial actions are to be taken to reach the desired comfort levels of the occupants.

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GM/FM

J. A M. Wijeratne
General Manager
Facility Management Division
Sri Lanka Telecom PLC

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V.D. Geekiyanage

Annexure IV Summerized data from the survey , Asset Arcade Office

Attribute & / Occup — Q. No	Privacy and Noise in the work station a											Support for the Team work, b				Lighting aspects in work station, c				Ventillation Aspects,d		Composite Score				Overall satis. (OES)
	a1	a2	a3	a4	a5	a6	a7	a8	a9	a10	a11	b12	b13	b14	b15	c16	c17	c18	c19	d20	d21	a	b	c	d	
1	6	6	6	6	6	6	6	6	7	7	7	6	7	7	7	6	6	7	6	3	5	69	27	25	8	8
2	2	3	3	5	6	4	3	3	4	5	6	4	6	6	4	6	6	4	5	2	2	44	20	21	4	3
3	2	2	1	2	4	1	2	2	3	4	4	2	4	1	2	4	4	5	4	1	4	27	9	17	5	2
4	2	2	4	4	2	2	2	4	5	3	1	1	1	3	2	4	4	4	1	1	2	31	7	13	3	1
5	4	4	3	2	5	5	3	3	4	4	2	5	4	2	4	3	2	4	7	2	2	39	15	16	4	4
6	1	1	1	1	1	1	1	1	4	4	1	1	4	4	4	6	6	4	1	1	1	17	13	17	2	2
7	4	4	4	4	4	1	4	7	6	6	6	4	6	6	6	4	4	4	4	7	4	50	22	16	11	4
8	4	5	4	4	4	5	4	6	6	6	5	4	6	4	4	5	4	4	1	2	4	53	18	14	6	4
9	1	2	3	3	6	4	3	6	6	6	4	5	6	6	6	6	6	6	2	1	5	44	23	20	6	6
10	4	2	2	2	2	2	3	6	6	6	5	4	4	6	6	6	6	6	6	3	3	40	20	24	6	4
11	1	2	4	4	6	2	2	6	6	6	4	6	6	1	4	4	4	4	1	1	3	43	17	13	4	4
12	1	2	2	3	6	1	2	5	6	5	4	6	4	6	6	6	6	6	2	2	1	37	22	20	3	5
13	4	3	6	6	6	4	3	6	6	6	4	6	4	6	6	6	6	5	5	3	6	54	22	22	9	6
14	4	4	5	5	6	4	6	3	6	6	4	6	6	7	6	2	4	6	6	1	4	53	25	18	5	6
15	6	6	6	5	6	6	6	6	6	5	5	4	6	6	6	6	6	6	5	4	5	63	22	23	9	6

Annexure V Summerized data from survey , HQ - 6th floor

Variable Attribute & Respondent Q. No	Privacy & Noise in the work station a											Support for the Team work, b				Lighting Aspects c				Ventillation Aspects,d		Composite Score				Overall satis. OES
	a1	a2	a3	a4	a5	a6	a7	a8	a9	a10	a11	b12	b13	b14	b15	c16	c17	c18	c19	d20	d21	a	b	c	d	
1	6	6	7	5	6	5	4	7	7	2	4	4	6	5	6	6	6	3	5	6	3	59	21	20	9	6
2	6	6	5	5	4	5	5	3	5	4	2	4	5	4	5	5	6	5	3	5	4	50	18	19	9	5
3	6	5	6	6	5	5	6	6	6	6	4	5	5	4	7	6	6	6	3	5	5	61	21	21	10	6
4	6	6	5	5	5	4	6	5	6	6	2	6	4	5	6	5	5	4	5	5	4	56	21	19	9	6
5	6	6	7	4	5	6	7	5	5	6	3	6	5	5	6	5	5	4	3	5	5	60	22	17	10	6
6	2	3	4	4	5	4	5	6	6	6	6	5	5	4	6	5	5	4	3	3	2	51	20	17	5	5
7	4	4	5	3	6	5	5	3	5	5	3	4	5	5	6	6	6	6	2	2	3	48	20	20	5	5
8	2	3	4	4	5	5	6	6	6	5	3	4	5	5	6	5	5	4	4	3	4	49	20	18	7	5
9	6	5	6	6	5	5	5	1	4	5	3	4	3	3	3	4	3	4	2	2	2	51	13	13	4	3
10	4	3	2	3	4	5	4	2	6	6	4	5	4	4	4	5	5	4	3	2	3	43	17	17	5	4
11	5	5	4	4	3	3	4	2	6	6	2	4	4	5	6	5	6	4	3	2	4	44	19	18	6	5
13	4	4	3	4	3	4	5	5	6	6	5	6	6	6	7	5	6	5	3	3	4	49	25	19	7	7
14	4	5	5	5	6	5	4	5	7	6	5	6	6	5	6	5	6	5	3	3	4	57	23	19	7	6
16	5	6	6	6	5	5	5	6	6	6	4	5	5	5	6	5	6	5	4	3	4	60	21	20	7	6
17	5	5	5	6	5	5	6	6	5	5	4	5	5	4	5	4	5	3	3	2	4	57	19	15	6	5
18	6	5	6	6	5	5	5	6	7	7	5	6	7	7	6	6	6	5	5	3	5	63	26	22	8	7
19	4	3	4	3	3	4	5	5	6	6	5	6	5	5	5	5	5	4	3	3	4	48	21	17	7	5
20	3	3	2	3	3	4	4	5	6	6	5	3	3	4	6	5	5	5	3	3	4	44	16	18	7	3
22	4	3	3	4	4	4	4	5	5	5	3	4	5	4	4	5	5	4	3	3	4	44	17	17	7	4
23	5	5	6	5	6	6	6	6	7	6	3	5	6	6	5	5	5	5	3	3	4	61	22	18	7	6
24	5	5	5	5	6	6	5	6	6	6	4	5	5	4	5	5	5	4	3	3	4	59	19	17	7	5
25	4	5	3	4	3	5	3	5	6	6	5	5	5	5	5	4	5	5	3	2	5	49	20	17	7	5
26	3	3	2	4	4	3	3	4	5	5	3	4	4	3	3	5	4	4	3	3	5	39	14	16	8	3
27	3	4	5	5	4	3	4	5	5	5	3	4	5	5	4	5	5	4	3	3	5	46	18	17	8	4
28	5	4	5	5	4	4	5	6	6	6	4	5	5	6	6	5	5	6	3	2	4	54	22	19	6	6
29	6	5	4	4	5	4	4	5	6	6	4	6	5	6	5	5	5	6	3	2	4	53	22	19	6	5
30	5	4	5	5	4	5	4	5	6	6	4	5	5	4	5	4	5	5	4	4	4	53	19	18	8	5
31	3	4	3	3	4	3	4	5	5	5	3	3	2	3	4	5	4	4	3	3	3	42	12	16	6	3
32	3	3	4	3	4	4	3	4	5	5	2	2	2	2	3	4	4	3	2	3	2	40	9	13	5	3
33	2	2	3	3	2	3	4	4	5	5	3	2	2	3	2	4	3	3	2	2	1	36	9	12	3	2
34	5	4	5	5	3	3	4	4	5	5	3	3	3	4	3	4	4	3	4	3	2	46	13	15	5	3
Total Score	137	134	139	137	136	137	144	148	177	170	113	141	142	140	156	152	156	136	99	96	115					