Investigating the impact of cultural, gender and professional design considerations on employee productivity: case study of female academics in Saudi female Universities

A thesis submitted for the degree of Doctor of Philosophy

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Abstract

Past research has confirmed that workplace design affects employee productivity. It is known to affect the employees both psychologically and professionally. Past researchers have looked at it from ergonomic, architectural and other perspectives. However, this research is limited to certain professions such as nursing and construction. However, the research indicates that sing workplace design it is possible to improve productivity of employees in other professions as well. This research aims to focus on how workplace designs can improve productivity of teachers. Teaching is an intellectual/ non manual work and hence design considerations for teachers should be more psychological in nature. Little research has been conducted on improving workplaces designs for non manual workers. Also past research has not paid sufficient attention to gender aspects of workplace design. This research looks at how designers' consideration of culture, gender and profession of the occupants at the time of designing will affect employees' perception of the psychological, social and functional quality of their workplace and consequently their productivity. This research primarily fills three gaps in existing literature: Firstly, it focuses on gender of occupants and how considering this during workplace design can affect the productivity of employees. Secondly, it looks at impact of workplace design on teachers, who carry out intellectual non manual work. Thirdly, this study is conducted in context of Saudi Arabia with an aim to reduce the scarcity of similar research in context of Saudi Arabia.

Data or this research was collected in two stages. Firstly, female academics provided self-observation data in form of comments using a mobile app which was developed specifically for the purpose of this research. This data was quantified using thematic analysis approach and quantified data was analysed using regression analysis. The second aspect of this research included collecting quantitative data using semi-structured interviews with designers who have worked on designing all-female universities in Saudi Arabia. This research finds that by taking cultural, gender and professional factors into consideration it is possible to improve the social, psychological and functional experience of occupants of the workplace and this is likely to improve their ability to achieve organisational and personal objectives. This research, thus concludes that cultural, gender and professional consideration affect the employees; ability to contribute to employees' and organisational outcomes.

Acknowledgement

This thesis has been prepared for the program of Doctor of Philosophy at Brunel University. It involved a lot of hard work but it has also been rewarding and interesting. This thesis has provided me with an opportunity to develop my skills within the area of workplace designing and I hope that it can contribute to present research as well as serve as an inspiration for future studies. However, this thesis would not have become reality if it was not for a number of people who all contributed to making this study possible.

First, I would like to thank the all mighty Allah for giving me the strength to overcome one of the most significant challenges of my academic life despite all the hardships. At times, I could only draw strength from his blessings which I am sure were with me.

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1. Introduction

1.0 Chapter introduction

This chapter provides an overview of why this research is useful in present context. In Saudi Arabia, there has been an ongoing discourse into increasing proportion of women in the workforce. This research is expected to make a significant contribution in this regard by focusing on workplace environmental aspects that affect Saudi Arabian women at the workplace. This chapter discusses why it may be useful to focus on culture, gender, and profession of occupants while designing workplaces. In addition, it presents the aim and objectives of the research.

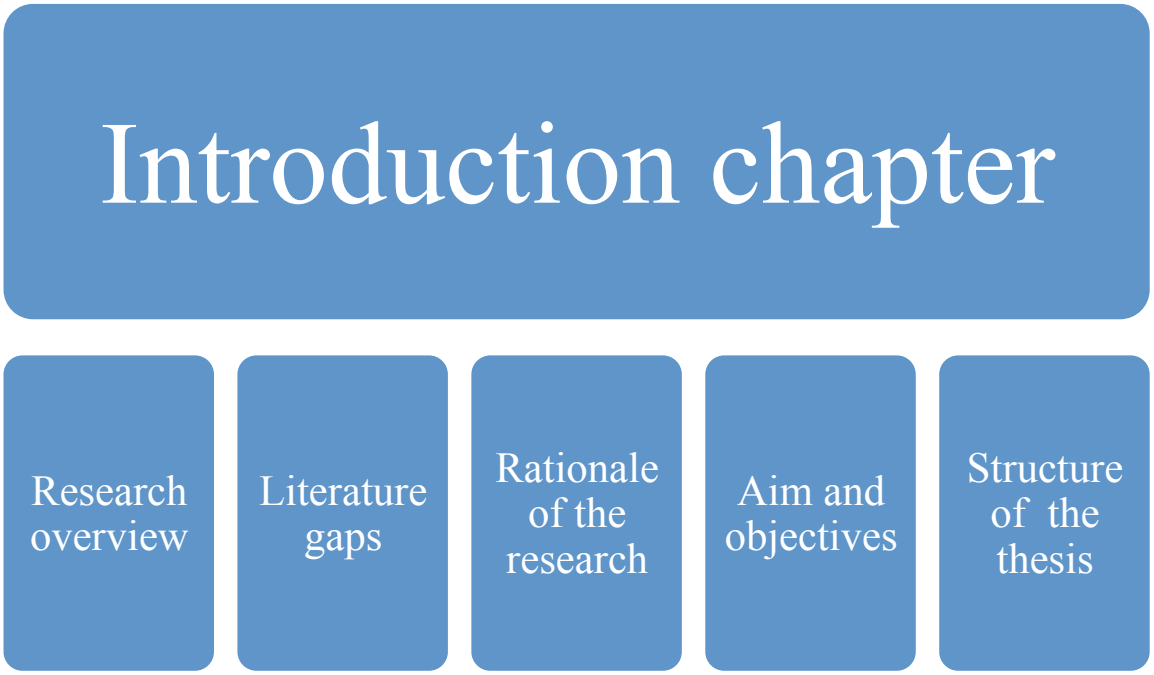


Figure 1: Chapter 1 structure

1.1 Overview

Most of the research conducted to investigate the relationship between workplace design and employee productivity have agreed that workplace design has a significant impact on the employee productivity (Benfield et al. 2015; Freivalds 2014; Oksanen and Ståhle, 2013; Hoskins, 2014; Dutt, 2012; Huang et al. 2012; Mak and Lui, 2012; Clements-Croome, 2011; Davis et al. 2011; Fisk et al. 2011; Kamarulzaman et al., 2011; Kekäläinen et al. 2010; McElroy and. Morrow, 2010). It affects employees in multiple ways such as increasing motivation, reducing stress (Fisk et al. 2011; Haapakangas et al. 2008) and reducing feelings of anxiety and absenteeism (Pejtersen et al. 2011). Oksanen and Ståhle (2013) go as far to claim that physical environment of the workplace may even affect people's innovation capabilities. In other words, it indicates that by suitably designing workplaces it is possible to reduce negative outcomes (such as anxiety and stress) and improve the likelihood of positive outcomes (such as improved motivation), innovation etc. (Golabchi et al. 2015; Lahtinena, Ruohomäki, Haapakangas and Reijula, 2015; Lopez and Gilkey, 2014; Freivalds, 2014, Pejtersen et al. 2011; McElroy and Morrow 2010).

Workplace design has been looked at from multiple perspectives by different researchers. For example, some authors looked at it from the physiological perspective (see for example, Golabchi et al. 2015; Lopez and Gilkey, 2014; Freivalds, 2014; Valsangkar and Sai, 2012) while some others looked at it from psychological (see, for example, Pejtersen et al. 2011; McElroy and Morrow 2010; Kaarlela-Tuomaala et al. 2009) or engineering perspectives (see, for example, Lahtinena et al. 2015). Workplace design is also seen from the architectural and organisational structure (i.e. hierarchy) perspective. Nickpour (2012), in her Ph.D. research, looked at workplace designing from designer's decision-making perspective. This research also looked at the decision making in workplace designing but unlike past research this research focuses on the factors that the designers consider when designing workplaces.

This research aimed to combine the lessons from most of past research and look at the interaction between workplace design and workplace occupants in a holistic perspective. This research looks at how workplace design affect the psychological, social and functional well-being of employees while also looking at the impact of workplace design on employees' productivity. This research thus attempts to take a more holistic approach to workplace design. Furthermore, this research also looks at the interaction between

workplace design and employee productivity from employees' perspective. This is a significant contribution to this research because in most of past research, employee productivity has been measured externally, for example, by external observers or using concrete measurable outputs. However, such measures are not applicable for professions where the output of the employees is not explicitly observable. In today's knowledge-based society a number of individual works in professions where their output is intellectual rather than physical making it difficult to measure the output. Teaching is one such profession where productivity of the teachers is visible in the quality of their interaction between teachers and students and quality of knowledge transfer that takes place. Hence this research employs a self-reporting observation method for collecting data on how employee productivity is influenced by workplace design.

Workplace designers consider a lot of aspects when designing workplaces but for the clients, one of the most important things is employee productivity. Employee productivity is directly linked with the physical, psychological and emotional comfort that the employees get at the workplace. Different aspects of workplace designs have a direct impact on the physical, psychological and emotional comfort of the employees and hence on their productivity (Schweiker et al. 2013). Increased personal control and comfort needs of employees triggered the concern among organisations to provide them with an environment and office design, which fulfills the employees 'needs and helps to boost their productivity (Freivalds 2014; Oksanen and Ståhle, 2013; Hameed and Amjad, 2009).

The past research has, however, ignored the fact that the manner in which individuals interact and derive physical, psychological and emotional comfort from their ambient environment may depend on several contextual factors. This research looks at three such factors- the culture, gender, and profession of the individual. This means that designers must take functional, psychological and social aspects of workplace and its occupants while designing workplaces.

This research particularly looks at how the designers link culture, gender and profession of the occupants of the workplace to determine how they are likely to derive physical, psychological and emotional comfort from the workplace. In addition, this research also considers how it impacts employee productivity. Employee productivity here does not refer to hard measures of productivity only as is commonly used in industrial studies but

rather also includes willingness, motivation, and ability of the individual to contribute to the goals of the organisation.

1.2 Current gaps in Workplace design and Employee productivity literature

Architecture and design firm, Gensler (2006) conducted a U.S. Workplace Survey. Based on the findings of this survey, Gensler (2006) concluded, "Office design has a direct correlation with optimal job performance, not to mention a company's competitive advantage. Businesses that ignore the design and layout of their workplaces are failing to optimize the full value of their human capital" (Beautyman, 2006). Workplace design makes a significant impact on the employees in form of improved motivation, attraction and satisfaction and also in improving firm's ability to retain employees (Golabchi et al. 2015; Lahtinena et al. 2015; Lopez and Gilkey, 2014; Freivalds, 2014, Pejtersen et al. 2011; McElroy and Morrow 2010). In today's competitive business environment in which employees play a key role in the success of the firm and where inter-firm competition for most skilled human resources has intensified to unprecedented levels, workplace design can help firms by improving its ability to retain employees (Oksanen and Ståhle, 2013).

Workplace design affects the cognitive abilities of individuals as well thereby allowing them to think creatively (Oksanen and Ståhle, 2013). This improves their response to changes such as technological changes in their environment. On the other hand, poorly designed workplaces could lead to higher level of stress and anxiety among employees which could eventually lead to poor performance (Freivalds 2014; Gutnick, 2007; Amble, 2005). Consequently, employers are looking to design workplaces that not only meet the physical needs of the employees but also satisfy them emotionally (Proper, 1998). Workspace design aspects such as colour, lights, space arrangement, and furnishings are effective in providing positive sensory stimulation to the employees. This, in turn, affects the performance of the employees positively. Other research such as the one conducted by the British Council for Offices and the Commission for Architecture and the Built Environment also found that environmental aspects such as lights could have a positive impact on the perception of individuals and may increase productivity while also reducing absenteeism (Amble, 2005).

Considering that different kind of workplace designs may work in different circumstances, office designs today are designed keeping the nature of activity in mind. In other words, the designs are becoming more flexible accommodating different designs within one office space, for different types of activities and the various phases of work processes: silent secluded spaces for individual tasks which require focus and concentration while open spaces for teamwork and formal and informal meeting areas. Changing nature of work is also affecting this changing choice of designs; for example, most professions today require employees to exchange information and to communicate as these could boost creativity and productivity among employees (Bakke, 2007). Firms are utilising multi-space concept instead of cell-based designs to maximise the utility of their workspaces. However, some authors have found that people have a contradictory perception of the usability of multi-space office solutions and the well-being of the users (McElroy and Morrow, 2010; van der Voordt, 2004).

Previous authors have ignored the profession of the Profession of workers in workplace design research have been largely ignored. Construction and healthcare industry are the two main sectors which have received the most attention in this regard with construction sector research clearly dominating the rest. For example, Golabchi et al. (2015) looked at the impact of workplace designs on the health outcomes of construction workers. The excessive focus on construction industry can be because of the presence of heavy equipment, physically demanding tools, hazardous materials, and rapidly changing work conditions, all of which increase the possibility of injuries (Abudayyeh et al. 2006). Due to this, the rate of accidents and fatalities is quite high in the construction sector as compared to in any other sector (Lopez and Gilkey 2014). The explicitness of the illnesses and accidents in the construction sector may be one of the main reasons why most researchers considering profession in workplace design research have been from the construction sector.

Poor designing of the workplace can have a multifaceted impact on the health and overall well-being of employees. For example, it may impose significant costs on employers because of absenteeism, lost productivity, and increased health care costs, disability, and workers' compensation costs (Valsangkar and Sai 2012).

One of the solutions proposed for preventing workplace-related illnesses is prevention through design but this is mainly focused in the construction sector where workplace hazards can lead to fatalities and lifelong illnesses. Prevention through design involves

integrating safety considerations into the design stage (Toole and Gambatese 2008). Researchers suggest that prevention through design can mitigate occupational health risks (Nussbaum et al. 2009). What these researchers have demonstrated is that using suitable designs is one approach that can be considered to reduce physical stress at work. In the same vein, this research is based on the assumption that by suitably designing workplaces it is possible to reduce mental, physiological and emotional stress and boost the productivity of employees.

Physiological research on the subject has been mainly scientific studies in fields such as ergonomics. For example, several researchers have used computers and probes to understand the movement of individuals in workplaces (see, for example, Freivalds 2014; Han and Lee, 2013; Ray and Teizer, 2012; Alwasel et al. 2011). However, ergonomics is useful only to study the movement of workers where the workers perform repetitive and mechanical tasks. There are several professions where the work of employees does not involve as much mechanical work such as in the case of teaching. Teachers' work is not mechanical but is rather mainly related to their state of mind in which they can be creative and use intellectual approach to dispensing their job responsibilities. What makes it even more complex is that different individual teachers may have different physical movements as their physical movements are not determined by their work but rather by their own personal preferences. Also, this may not be always repetitive. Thus, ergonomics may not be the most suitable approach to study workplace designs when considering professions such as teaching.

Another key aspect that has been largely ignored in the past research on workplace design is the gender of the occupants. Broadly speaking, working allows people to earn and meet their material needs thereby improving their overall well-being. Women can look for work outside which helps in improving their overall well-being (European Agency for Safety and Health at Work, 2009). However, workplace accidents and hazards continue to cause millions of occupational accidents every year claiming several lives (House Committee on Education and Labor, 2008). There is a great deal of gender segregation in certain jobs and this means that males and females, in these industry sectors, face completely different types of work-related hazards (Schiffman, 2007; Nemoto, 2003). For example, mining and construction industries are male dominated and they are likely to face risks such as falls, noise and substance pollution, failure of organs due to long-term exposure to dangerous substances etc. (Tawatsupa, 2010). On the other

hand, women are generally employed in professions which are less manual in nature such as teaching, nursing, retail etc. In such sectors women suffer from different kinds of occupational risks such as monotonous work condition, increased anxiety and depression, fatigue etc. (Rugulies et al. 2008; Kivimaki, 2007).

Due to the difference in their physical appearance males and females are likely to face a different kind of exposure even when exposed to the same physical environment; for example, many of the tools that males can handle with ease may not be suitable for regular handling by females (Taiwo, 2009). For example, Seifert and Messing (2006) looked at the problems faced by female hotel cleaners and concluded that in most cases the supply carts are designed keeping in mind the males and consequently their designs are not suitable for females. The bar in these supply carts was found to be too high for the majority of female cleaners included in the study. Such problems are known to be common in cases when females enter a job environment which had been dominated by males (Courville et al. 1999). In Saudi universities, most of the teachers used to be males. Rise in female participation in education is quite recent and consequently, there is a possibility that most of the university buildings and facilities are designed keeping Saudi males in mind. It may make it difficult for female staff members to use these facilities as they have different physical appearance and needs as compared to men. This is a possibility which has largely been ignored in past research. According to Chiron (2008) and Premji et al. (2008) difference in physiological characteristics of males and females affects their ability to respond to their environment and consequently on the difficulties they may face in the workplace. According to Premji et al. (2008) women are often at disadvantage because of the greater focus on male employees in most industry sectors which means that the environment and most of the facilities are designed as per the needs of male employees. For example, women may require different means of relaxing themselves as compared to males. Frumkin and Pransky (1999) commented that females may feel disadvantaged at work due to different environmental issues and this could affect their levels of anxiety and stress. Dembe (1999) commented that certain individuals may feel disadvantaged because of lack of opportunities to engage in positive health behaviours. Factors such as culture also play a role in this regard, especially in developing countries. For example, in Saudi Arabia females are generally confined indoor which affects their ability to relax; for example, they will feel restrictions in going outdoors to enjoy the natural environment and hence most of the work done on improving the external environment is likely to be of little benefit to these women.

According to World Health Organisation, a healthy workplace can be defined as one which duly considers the physical work environment, the psychosocial work environment, personal health resources in the workplace, and enterprise-community involvement (Burton, 2010). Since the needs of males and females may differ across these avenues it is essential to consider the implications of designed workplace for both males and females. World Health Organisation (2010) report states that "treating everyone the same, although well intentioned, can result in missed opportunities to consider the specific needs and experiences of different groups. For instance, providing all workers with equipment of the same size ignores differences in body dimensions between men and women. This can lead to the equipment being difficult to use or even dangerous for one of the sexes." WHO (2010) therefore, recommends a gender-based approach to workplace design. The gender-based approach here refers to the systematic integration of "gender perspective in the design, implementation, monitoring and evaluation of policies, programs or practices." However, no present research has investigated how gender profile of the occupants affects their design needs and consequently the relationship between workplace design and employee productivity.

While many researchers have mentioned specifically considering the gender and culture of the employees while designing most of the past research have focused solely on professional aspects. Thus the current research lacks in respect with consideration of profession, culture, and gender of the occupants when looking at how workplace design affect the productivity of employees. This research aimed to overcome these gaps. By using a very specific case of Saudi Arabian (cultural) female (Gender) academicians (profession) teaching in Saudi Arabian universities this research aimed to highlight the significance of considering gender, profession, and culture of occupants when designing workplaces.

1.3 Rationale for the research

The relationship between workplace design and employee productivity has been researched by several researchers in different contexts. However, the current research lacks in many respects. While there has been some gender-related research on workplace design and impact on employees but such research is still quite scarce. Considering the constantly rising proportion of females in the workforce and considering the established

fact that men and women have different workplace design needs and impacts it is quite surprising that researchers have not looked at the impact on female occupants. This is particularly relevant for Saudi Arabia where gender segregation characterises the workforce and where female participation in the workforce is on the rise. However, there is a significant scope for improvement. The researcher believes that by increasing the satisfaction levels of women employees with workplace can help in improving their participation in the workforce and in this respect can contribute quite significantly to increased workforce participation of women in Saudi Arabia.

This warrants development of knowledge regarding workplace design for female workers. Saudi Arabia has been traditionally male dominated society and as a result, most of the workplaces are designed bearing the needs of male workers which can be inherently different from that of female workers. It is thus essential to conduct gender-related research into workplace design and employee productivity.

Secondly, there has been some generalisation in terms of the profession of the employees. Apart from the medical profession, there has been little related into how the relationship between workplace design and employee productivity is influenced by the profession of the occupants. Workplace affects the cognitive and practical aspects of work. Hence it is essential to consider nature of work when considering how workplace design can affect employee performance. Thus this research aims to fill for lack of research into how the relationship between workplace design and employee productivity is influenced by the nature of work of occupants. In this context, nature of works needs to be considered including aspects such as social, psychological and professional nature of work. For example, teachers need a quiet yet mentally stimulating environment for them to be able to teach effectively and creatively.

Finally, culture is one of the aspects that have been largely missing from workplace design research. This could be because of the widely held view of diverse workforces. However, not all the workforces around the world are diverse and hence we must explore the issue of workplace design in the context of culturally homogenous workforces. In this respect, it is critical to understand the impact of culture on the relationship between workplace design and employee productivity. Human needs, perceptions and behaviours are influenced by their cultural environment and hence it is essential to consider the impact of culture on the relationship between workplace design and employee productivity.

This research was conducted in all-female universities in Saudi Arabia. These workplaces are extremely homogenous in that it mostly consists of Arabic female professors teaching Arabic female students. Considering the significance of the role that these professors are playing in the development of female education in the Kingdom it was considered essential to investigate how workplaces can be designed to make them more effective and productive in their work. Researcher herself aims to teach in an all-female university in the Kingdom up completion of her research and this research will help her contribute to the development and improvement of her own workplace.

The current level of research on workplace design is overly generalised but there is enough argument supporting the view that workplaces cannot be designed based on generalised concepts but should be rather very specific to profile of the occupants and nature of their work. This is one of the gaps that this research aimed to fill. The researcher hopes that this research will motivate other researchers to conduct similar context specific research into workplace design.

This research also looks at ways of evaluating employee productivity. The researcher believes that employee productivity is contextual to the job. For example, the productivity of a mill worker could be estimated from the number of units assembled while that of a restaurant employee can be estimated from the number of customers served. However, for some jobs, the output is not as explicit and requires a novel way of estimating productivity. Teaching is a profession where the employee output is not explicit and this must reflect in how the productivity of teachers is evaluated. This research proposes a novel ay of evaluating teacher productivity and that is from the perspective of the teachers themselves. Past research on teacher productivity used students' perspective and peer perspective but have not looked into evaluating productivity from the perspective of the teachers themselves. This is especially critical in this research which looks at how workplace design affects their productivity. This is one relationship which can only be seen from the perspective of the teachers themselves. This research thus also proposes that when measuring productivity it is essential to consider the context in which productivity is being measured.

1.4 Aims and objectives

The main aim of this thesis is to evaluate the impact of accommodating professional, cultural and gender considerations when designing workplaces on the productivity of academics in Saudi all-female universities. In this context, this research assumes that the key purpose of designing function is to design productive workplaces where individuals will get physical, emotional and psychological comfort to be able to become productive at their work.

Objectives of Study

The overarching aim of the study will be achieved through the fulfillment of the following objectives:

1. To identify different aspects of workplace environment that designers consider when designing workplaces.
2. To identify the link between workplace design and employee productivity.
3. To evaluate the impact of consideration of occupants' gender during workplace designing on employee productivity in Saudi female universities.
4. To evaluate the impact of consideration of occupants' culture during workplace designing on employee productivity in Saudi female universities.
5. To evaluate the impact of consideration of occupants' profession during workplace designing on employee productivity in Saudi female universities.
6. To identify an adequate strategy for accommodating cultural, professional and gender characteristics of the occupant employees while designing workplaces that boost productivity

1.5 Context of the study

If the workplaces are designed with people who work at these workplaces in mind it is possible to boost the overall productivity of the workforce. At the same time, it will help organisations in retaining their employees. Thus, before designing workplaces we need to see who will be using it and how. It is, therefore, critical to look at both the work (i.e. profession) and the worker (i.e. personal attributes). In terms of personal attributes what sets one group of individuals different from other is the culture and gender. These two have a significant influence on human personalities.

This study was carried out in Saudi Arabian all-female universities. After years of neglect, Saudi Arabian government has, within last decade, increased its emphasis on women employment. Consequently, there is a rise in investment in female education and there are also now more job opportunities for females. Despite these attempts, the participation of women in the workforce in Saudi Arabia remains quite low.

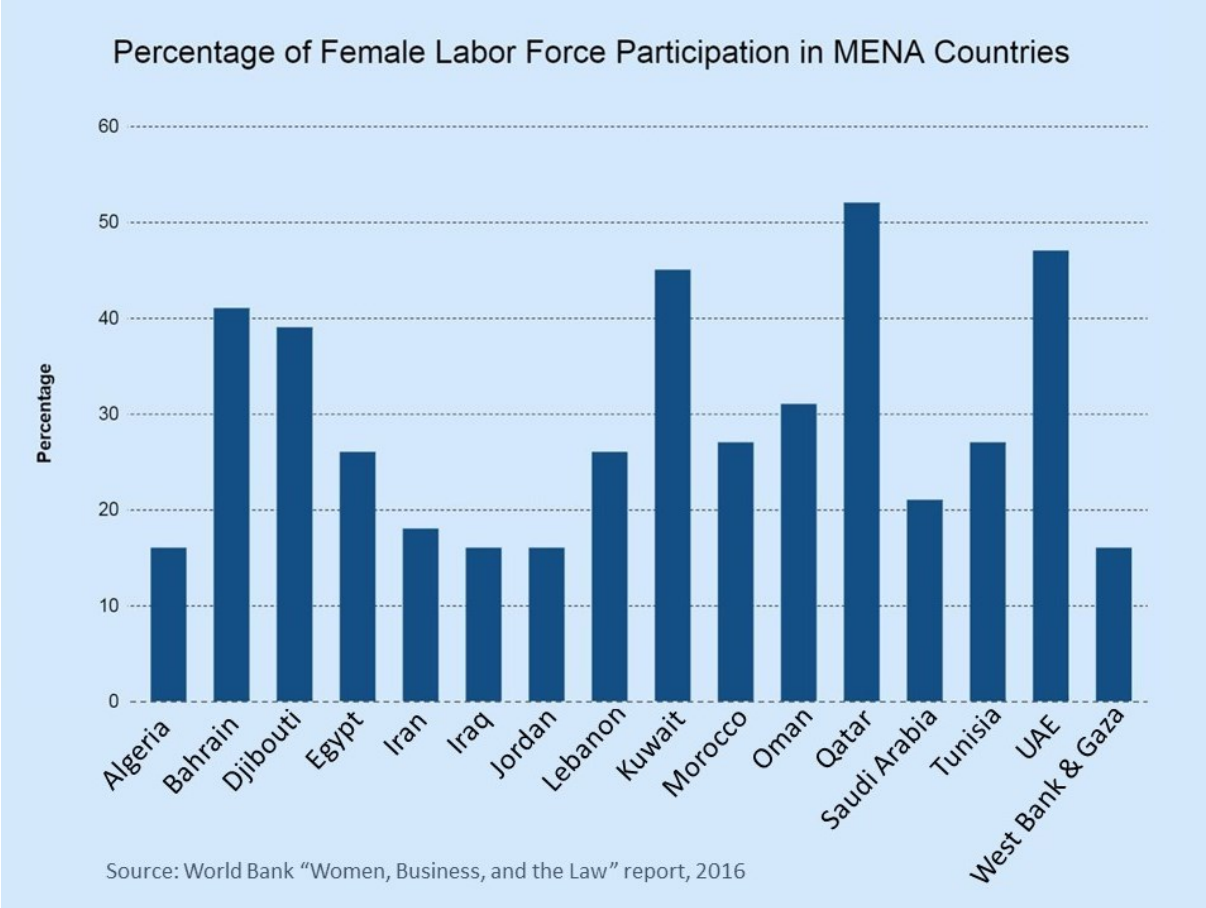


Figure 2: Percentage of female labour force participation in MEAN countries in 2016

This is driven by two aspects: both demand and supply. On one hand there is still a relative lack of opportunities and poor working environment for women in Saudi Arabia; for example, women workplaces are quite restricted and they are not allowed to interact with any unfamiliar male. On the other hand, there is a general reluctance among Saudi women in terms of work because most of them still do not associate themselves with workplaces. In fact, the problem of lower participation of women in workforce is a trend seen around the world barring a few countries. However, socio-economic success of the countries where women participation in the workforce is high indicates that increase participation of women in the workforce is one way of improving socio-economic situation of the society. In this respect, the barriers to increasing female participation in the workforce should be removed.

One of the barriers in this regard is workplace design. Over the years, workplaces in Saudi Arabia have been designed primarily for male workers because in most likely cases the employees were males. For some reason, over the years we have started to associated workplace and work culture with masculine attributes such as competitiveness, power etc.

For the purpose of this research Saudi, all-female universities are selected as case studies. Following are some of the reasons behind this choice:

- Many of the individuals who motivated the researcher to study this topic were university teachers. From their experiences, the researcher knew that such a problem might exist in Saudi universities and hence she decided to investigate it.
- Gender issue in the workforce is not as prominent in any other country as in Saudi Arabia due to complete gender segregation culture of Saudi Arabia. Also, most past research on workplace design and employee productivity has been conducted in the context of manual jobs but very few in intellectual roles. Teaching is a creative and intellectual work which requires a different kind of design considerations.
- Universities are likely to play a very critical role in the upliftment of women in terms of participation in the workforce. Hence improving workplace design at universities is critical not only for the people working there but also the students as the quality of teaching reflects in the quality of learning.
- The researcher is Saudi national and she has first-hand experience of challenges that women face at workplaces. She is better equipped to investigate the issue in

the Saudi context. She also wants to make a serious contribution towards improving the lives of Saudi women who are trying to find their ground in Saudi workforce. By this research, the researcher aims to make a small contribution towards improving the work environment for Saudi women and consequently towards their rise in the workforce.

- One of the key factors mentioned in the 2030 vision for Saudi Arabia is an increase in the number of opportunities for women. The problem is that this will not provide the desired benefits if we do not improve the workplace environment for women. With this research, the researcher aims to contribute to the success of the 2030 vision for her nation.
- Billions of dollars are being spent in improving university education in Saudi Arabia. This will be a waste if the teachers are not able to perform their duties adequately. The main ingredient in quality education is the quality of teaching itself. This can only be improved through the personal and professional development of teachers and giving them an environment which is conducive to information sharing, interpersonal interaction, creativity and innovation and knowledge construction. Teachers need a mentally stimulating environment to be creative and teach students. Unless the workplace is designed to mentally stimulate and physically and emotionally relax the teachers, they cannot provide quality education to the students.

These reasons justify the need to carry out a research for improving workplace design for female academics in Saudi Arabia.

1.6 Structure of the thesis

There are six chapters in this thesis. The first chapter is the introduction chapter. In this chapter, the key aspects of the problem are discussed including why it is critical to investigate this problem. The key research gaps have been highlighted in the rationale section. Rationale section also outlines why considering gender, profession and culture background of the occupants is critical to designing workplace which will play a constructive role in boosting the productivity of the employees. This chapter sheds some light on different perspectives that researchers have taken on improving workplace designs to boost the productivity of employees. This chapter mentions some key benefits

and challenges in designing workplaces. This chapter also presents the aim and objectives that this research aims to achieve.

Chapter 2 of this thesis reviews the existing literature on workplace designing and employee productivity. This chapter is divided into three parts. The first part of this chapter talks about different perspectives and contexts in which workplace designing has been discussed by past researchers. The second part of this chapter talks specifically about measuring employee productivity. This part of the chapter talks about different ways of measuring employee productivity as has been used by researchers in past research. Finally the third part of this chapter review literature on past research findings on the link between workplace designing and employee productivity.

Developing a coherent and well-thought data collection strategy is critical to achieving the objectives of any research. Chapter three contains the details of the data collection and analysis methodology adopted for this research. This research is based on pragmatist philosophy and mixed ontology. This research aims to find out how people interact with their workplaces and how, in turn, workplace design affects their productivity. While this information can only be obtained in qualitative fashion but it is essential to evaluate if the findings regarding how workplace design affect employee productivity can be generalised. It is also essential to learn whether and how people's interaction with workplace may affect their productivity. For this reason, this research adopts mixed methodology because it was considered essential that multiple methods are used and the data is analysed in both quantitative and qualitative manner to achieve generalisation as well as obtain the required level of insight. The data collection and analysis part of the chapter is divided into two parts. The first part is the quantitative methodology part which provides reasons for selection of quantitative methods. Quantitative data for this research was collected using a novel method using a mobile app. This chapter discusses the reasons for selecting this novel method of collecting data and also how the collected data was quantified i.e. converted from qualitative to quantitative data. The next part of this chapter talks about the collection of qualitative data using semi-structured interviews with designers. Workplace designers are subject experts who can provide specific information about what aspects are considered while making decisions on workplace designs and how it is perceived to affect the employees.

Next chapter discusses the data obtained from the teachers. This presents the results of the quantitative data analysis including the findings of the regression analysis used for

establishing the relationship between different kinds of workplace design considerations and employee productivity. This is followed by some qualitative discussion of the comments posted by teachers on the mobile chat application. Following this, the data obtained from the interviews with the designers is qualitative analysed.

Chapter five combines the findings of the analysis of data obtained from interviews with designers and mobile app data obtained from teachers. The findings are discussed in light of the findings of the literature review. The comparison is drawn with existing research and researcher provides her opinion on why similarities and contradictions might exist between past research and the findings of this research.

Finally, chapter six concludes the research. The key findings and contributions of the research are discussed along with its limitations.

2. Literature review

2.0 Introduction

This chapter presents a review of existing literature on the subjects of workplace designing and how it affects employee productivity. This chapter looks at the research on the impact of workplace design on employee productivity from different perspectives. In this context, this chapter discusses workplace design from multiple perspectives such as environmental psychology, occupational heath, architectural and new worldview approach. This chapter looks at how workplace design affects employee productivity at both individual and group levels. Individual level aspects discussed include aspects such as responsiveness, privacy, personal control etc. while group level aspects discussed include team working, communication and cohesiveness.

The office building today has become the embodiment of economic power while also being representative of the fruitful future and therefore is a prominent piece in the urban landscape. Furthermore, being the place where a majority of employed folk today spend over 40 hours of their week, it especially impacts the lives of numerous people in our society in a significant way.

It may not be a surprise therefore that when these office spaces are designed poorly, they translate to a poor working environment which in turn impacts the employees' mental and physical health and in turn impacts their productivity leading to greater costs (Milczarek, Schneider, and Rial González, 2009; European Commission, 2002b). There have been higher instances of sick leaves among white collar workers latterly and mental health has been identified as the leading reason for these leaves (Åsberg, Nygren, Rylander, and Rydmark, 2002). There has been a greater demand to improve working conditions, especially because people have been working longer hours because of financial reasons and furthermore, because of the aging population, the workers are also older on average (Westerlund et al., 2009).

There has already been plenty of evidence that establishes a connection between job satisfaction and the psychosocial aspects of work, however, the question now remains

whether the physical environment in the office plays a role in determining the productivity of the employees that work there.

According to Lynch (1960, cited in Danielsson, 2010), our brain evaluates our environment based on our sight, hearing, touch and emotions and through that we are able to perceive the world. He explains the process with an example of the door – when you look at a door, you first identify the object as a door and then process the function of the object and this helps you identify its purpose and through this process between the observer and observed you are able to form a perception or an image of your environment. The physical environment is, therefore, crucial to our perception of the workplace, especially since people spend such a significant amount of time at work.

There are several fields apart from the obvious, architecture that deals with the impact of one's environment of them, specifically the office setting: 1) organisational-oriented research, 2) environmental psychology, and 3) occupational health which deals with aspects of social and stress medicine. They are four very distinct fields, but they seem to share one idea in common, however, that architecture plays an important role in organisations and especially towards their employees and each of these fields has their own unique approach and measure of how that is determined.

The buildings that businesses are based in serve as a template for the type of activities that are going to take place in those settings. The design itself does not have a causative effect on the employees' productivity; however, through aspects such as aesthetics, functional and social interactions and group patterns i.e. how these employees communicate and work in harmony, we can see an impact of the design indirectly. The one thing all organisational theories acknowledge is that design plays an importance role in achieving higher productivity and creativity. Also that, architecture is often what facilitates in shaping the perception of the employees towards their workplace and therefore this aspect has peaked the interest of many in the field of organisational-oriented research. The field approaches the subject from an individual as well as an organisational point of view and accordingly, they look at the varied outcomes that result through their approaches. The interests of management and organisations in architecture have been represented in studies in many ways. For instance, does Kupritz' (2002) consider the design an important aspect in human resource development training in the corporate world, while Pfeffer (1997) whose focus is on the social aspects of the work acknowledges the role of architecture in social situations.

Contrarily, Baldry et al. (1997) associate employee well-being, productivity and work process to the physical work environment. Most researchers that study the impact of office design are interestingly in the behavioural or design fields and not so many from the management field (Cohen, 2007). However, across all these fields, there is agreement on the fact that people make organisations and therefore the success of an organisation is associated with employees' quality of work. The workplace is but one factor in determining this. Becker frames it in this way: "In the short run, productivity defined in terms of strict output measures may make sense, but in the long run, the absenteeism and turnover stimulated by the changes required to obtain high productivity in the short run may impose a significant cost on the organisation" (Becker, 1981, p. 94).

2.1 Workplace dimensions and employee productivity

Kern, Breining, and Eckert (1994), focused on the design of production sites. They claimed that production sites cannot work without the human element and therefore they become an important factor. And therefore to enable humans in the production business work optimally, it is important to design the workplace to cater to their comfort and needs. It, is, therefore imperative to design the workspace appropriately to be able to assimilate the workers into the production process, be it for the economic, humanitarian or social interests. The production process is therefore greatly affected by the design of the workplace. Poorly designed workplaces often tend to yield poor effort from the employees through poor quality, high absenteeism, and high social insurance as a result of more instances of occupational diseases.

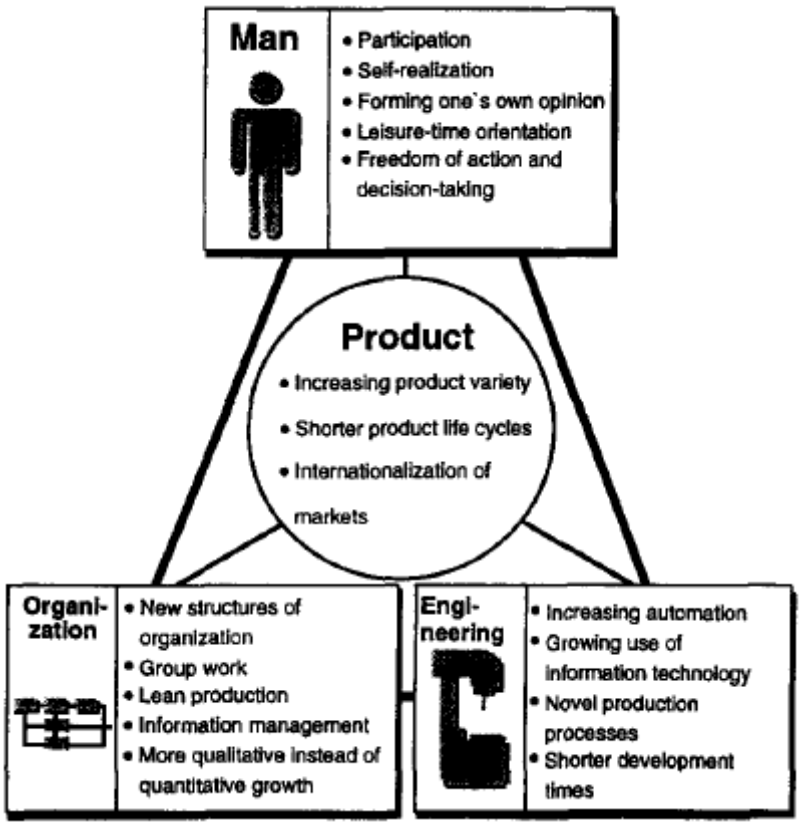


Figure 3: Workplace design dimensions. Source: Kern et al. (1994)

The workplace is the determining factor for the success of the production process to its various components, i.e. equipment, the product and its components and humans. The purpose of linking the produced product to humans, the equipment as well as the organisation allows us to take an interdisciplinary approach toward the process. The factors that comprise this interdisciplinary approach are represented in the figure above (Fig. 1).

People's expectation from their work environment is gradually changing as a result of the changing external conditions. These factors can be categorized in three of the following classes, parallel to the influencing spheres: technical and functional requirements, human-related requirements, and organisational requirements. Furthermore, many offices will change given the change in society from an industrial one to an information society (Kern et al. 1994).

Since the first meeting of the Environmental Design Research Association in 1969, the design process has been taking a more social approach and they have made some notable achievements in the process. This is especially made evident given all the research being

conducted on the subject matter in the fields of environmental design as well as other related human sciences, with a significant number of these studies focusing on the environmental-behavioural relationship (EDRA, 1969 – 2011).

The programming in a particular field was formerly more concentrated on more technical things such as the studies of sites, project size, spatial demand, cost and financial constraints, regulations, etc. however, as a result of the social/behavioural design approach being used, they began integrating the study of behavioural setting to best cater to the requirement of the employees (Frontczak and Wargocki, 2011; World Health Organisation 2010, de Croon et al. 2005). For instance, architects to optimize work performance take into consideration social setting of the office (Pejtersen, et al. 2006). Lately, there has been a new 'social cushion' concept, and since no individual actually exists outside the context of culture, the industrial and urban relevance of social cushioning have become very important. "So immersed in the social cushion does each person become that the physical environment is lost as a separate reality. The social cushion becomes the only eyes through which to see the world" (Bechtel, 1997, cited in Horayangkura, 2012: 33).

In order to improve the habitability of the constructed environment, social design practitioners have specifically matched certain behaviours to the particular setting of these places. As a result, the associated psychological outcomes such as satisfaction, productivity, control perception can be determined during the process.

According to a hypothesis proposed by Leanman (1990, cited in Hammed and Amjad, 2009), the quality of the work environment is directly associated with the productivity at the workplace. To prove this, he conducted a survey targeting dissatisfied employees to find if it was, in fact, a result of their environment. According to his survey "people who are unhappy with temperature, air quality, lighting and noise conditions in their offices are more likely to say that this affects their productivity at work" (Leaman, 1995: 13).

Leaman (1995) also reported an association between the employees that claimed that their work environment is responsible for their lack of productivity and those that claimed to be dissatisfied with their work environment; there is also ample amounts of findings that support this finding. However, he also claimed that there was no statistically significant association between satisfaction with the work environment and self-reported productivity. Since correlation doesn't necessarily imply causality, the results need to be

evaluated carefully to avoid the generalization. Furthermore, it must be taken into account that the productivity was measured based on one single question.

There were others, apart from Leaman, who also found an association between dissatisfaction and lack of productivity. Oselandand Bartlett (1999) conducted a similar survey across 10 office buildings only to draw the same conclusions. However, they also gave credit to the fact that the answers from the participants could have been swayed by the manner in which the questions were posed i.e. "Considering the effect on your performance, how satisfied are you with the office facilities and services?" (Oselandand Bartlett, 1999: 92).

How much control the people think they have over their own work significantly reflects in their productivity (Leaman's, 1995). These findings, that there is a relationship between perceived control and productivity further concurred through Oseland and Bartlett's (1999) studies.

Leaman (1995) also proposed another very interesting factor, "Forgiveness". This considers the aspects of the workplaces or better yet, the shortcomings of the workplace that the employees are willing to let go of. He also adds that "forgiveness" can be increased if the employees "Know that every effort is made to overcome them, and they will usually tolerate problems which they understand are hard to solve" (Leaman, 1995: 150).

It can be tricky to shortlist precisely what factors must be considered when looking at an office environment. After reviewing an acceptable amount of material and literature on the subject, Oseland (1999) concluded that satisfaction with the working environment was an important contributing factor to the productivity of the employees. Satisfaction with one's environment comes from a combination of physiological and psychological components, which is further shaped by the physical conditions.

	Environmental Satisfaction (Comfort)
Environmental Conditions	Physical Conditions, Space, Ergonomics, Aesthetics
Physiology	Gender, Age, Ethnic Group
Psychology	Personality, Expectations, Experience, etc

Table 1: Components of environmental satisfaction. Source: Oseland (1991)

Oseland (1999) acknowledges that physiological and psychological components play a critical role in productivity, however, this review centers mainly on the environmental aspect of the workplace, which are divided into:

	Environmental Conditions
Physical Conditions	Temperature, Light, Noise, air quality etc
Space	Plan, Layout, Privacy
Ergonomics	Work-station, Controls

Table 2: Elements of environmental conditions. Source: (Oseland, 1999)

One of the more effective approaches to understanding the physical environment is to group the conditions into various dimensions. Arguably, the behavioural aspect of the workplace still needs to be understood (Haynes, 2005). Fitch (2004) suggested that they use the aspect of dissatisfaction with the workplace instead to measure productivity. He justified this with reference to a study that established a strong relationship between the productivity and the satisfaction of the employees with the office environment (Fitch, 2004). Taking yet another approach, Clark et. al. attempt to form a model taking into account the relationship between satisfaction, self-reported productivity as well as the building performance. Generally speaking, this may work, but looking at it in greater detail, they are ignoring some crucial aspects (Clark et al, 2004), it is, therefore, essential as well as potentially more beneficial to consider several approaches. Finding the right and most accurate measure of productivity is far from accomplished, as many authors claim it is like “search for the holy grail” (Mawson, 2002).

In their ground-breaking work, Leaman and Bordass (2000), try to understand -“What features of workplaces under the control of designers and managers significantly influence human productivity?” This happens to be a very fitting approach as it restricts the research to specific boundaries by only focusing on the aspects that can be prejudiced by designers or facilities managers as oppose to general aspects like stress, attitude, job satisfaction and such. In the same study, the researchers define“killer” variables as those that have a“critical influence on the overall behaviour of a system” (Leaman and Bordass, 2000: 171).

These so-called “killer” are divided into five groups – personal control, responsiveness, building depth, work groups (Leaman and Bordass, 2000) and design intent (Leaman and Bordass, 2005).

In a study conducted by Leaman and Bordass (2000) that covered 11 UK based work buildings, it was found that in 7 out of the 11 cases there was an evident association between perception of control and self-reported productivity. To them, the most important factor that the occupiers were concerned with was the lack of control over their environment. Whitley et al (1996) concurred with this claim and added that people who have ‘internal locus of control’ tend to be more productive when they perceive that they have control over their surroundings (Haynes, 2008).

How promptly and efficiently any expressed concern about the environment is taken care of by the Facilities Management (FM) in an organisation can be described by a single word, Responsiveness. This concept might be related to the forgiveness one that was established earlier. Furthermore, if people at the workplace are kept in the loop about their concerns, i.e. through responsiveness, they are probably more likely to be more forgiving (Haynes, 2008).

Associating poor health with dependence on the environmental systems like the air conditioner causes people to develop a negative perception of their environment. This explains the findings that buildings that are deeper than 15m and air-conditioned have a more negative effect on how productive people perceive they are while those buildings that are less than 15m and have natural ventilation or air through windows, leads to a more positive perception of productivity (Haynes, 2008).

The fourth cluster of variables deals with workgroups. However, Leaman and Bordass (2000) have only occasionally been successful at evaluating both productivity and workgroup at the same time. They established that “that perception of productivity are higher in smaller more integrated work groups” (Leaman and Bordass, 2000: 183).

According to some other studies, there is causality between the productivity level and the number of people working in association(Olson, 2002; Fitch, 2004). According to Olson (2002) to improve productivity, it can be beneficial to move away from open-plan environments to more private, cubicle-type office environment.

Another so-called "killer" variable that Leaman and Bordass (2005) added is 'design intent'. This talks about the actual intention of the office and the true way in which it is being used. The designer by this thinking needs to clearly explain to the occupants the exact way in which the office should be used. It is, therefore, imperative that the design is as intuitive as possible. Several activities that the office workers often take part in must be considered to ensure they design an appropriate environment for optimum work (Haynes, 2007a).

According to Leaman and Bordass (2005), offices cater to human productivity best when:

- There is scope for personal control
- The environmental issues are taken care of promptly
- The plan forms include more natural ventilation and less technical and management-intensive systems
- Enough workspace per person, and appropriate distribution and control of heating, cooling, lighting and ventilation.
- Finally, the designer explains to the office occupiers the goal of the design intent.

In addition to prompt communication in case of changes, the office occupants are explained how things are supposed to work. According to Clemens- Croome (2003), an effective means of increasing productivity in a workplace is through support for improved FM. He states that by ensuring healthy buildings, can lead to both, greater energy savings and also increase productivity. This does not limit simply to the design of the building, can be moved along further by improvisation to the management and the FM department. According to them, most often, the complaints are about thermal problems, stuffiness, sick building syndrome, and crowding. It is estimated that by improving the office environment alone can lead to around 4-10% increase in productivity.

Office productivity is assessed using the OPN or the office productivity network using two occupant tools, which are OPN survey and OPN Index (Oseland, 2004). The survey consists of a questionnaire, that is administered online or on paper. Oseland (1004) claims he has distributed surveys in 60 buildings and received over 65,000 responses. While the staff themselves must complete the OPN survey, the Index is measured using

one on one interview by selected staff using specific interview Pro-forma since it is important for them to have knowledge about the office building design and operation.

They study was divided based into the following sections (Oseland, 2004):

- Satisfaction with Facilities –19 questions about with design and amenities e.g. workspace, meeting areas, technology) and whether they are satisfactory and conducive to working. The only activities questioned about herein contribute to the productivity;
- Satisfaction with Environment - 15 questions asking about their surroundings and if they are satisfactory and conducive to working (e.g. temperature, noise, privacy);
- Importance - 2 questions ask the subjects to tell us what they think are the key factor that helps their work;
- Self-assessed Productivity - 2 questions asking to what extent they believe their productivity is affected by their environment;
- Downtime - 18 questions to estimate the time wasted on account of poor and inconvenient design around their work (the motivation for these question was the result of the focus groups conducted prior to the survey);
- Satisfaction with Work Activities - 11 questions about whether the current design facilitates work activities such as teamwork, flow of ideas, etc.;
- Work Duties - 12 questions to estimate how long they take to perform their work in total (e.g. PC work, telephone usage, formal meetings);
- Work Time - 7 questions asking about the work time in and out of the office;
- Background Details –questions to establish the position and other such factors of the person being surveyed.

Oseland (2004) draws two comparisons that are noteworthy, he compared: 1) facilities and their impact on productivity and 2) the environment and ethics. He then uses the same nine-point assessment scale as used by as Leaman (1995) and Leaman and Bordass (2000) as a productivity scale.

Oseland (2004) in contrast to Leaman (1995) and Leaman and Bordass (2000), focuses on the facilities as well as the environment. This combinatorial approach is arguably a more accurate measure of productivity, i.e. from one question to two questions on productivity. However, this does not include the evaluation of the subcomponent of facilities and environment with regard to productivity. Using multiple regression analysis, Oseland (2004) proposed that there is an evident relationship between overall satisfaction with the environment and facilities.

"Downtime" is a concept that was proposed to define the time wasted as a result of poor design and management of the office environment. Interestingly, Oseland (2004) found that there was a negative correlation between downtime and productivity or facilities and environment. Occupiers are more dissatisfied with the more time they spend with poor office design and management. Oseland (2004) further elaborates on some of the downtime factors like waiting for lifts, walking between buildings, interruptions, waiting at fax and copier machines, could actually be opportunities for ad hoc conversations and knowledge transfer (Haynes 2005).

According to Oseland's (2004) analysis of the database "hygiene factors" such as ventilation and temperature, are the factors that occupiers are most unhappy with. He explains that this raises the requirement for more individual control. Similarly, Leaman and Bordass (2000) also concurred with these findings. However, these results are often obtained from open-plan offices and often these studies ignore the disadvantages of the open-plan settings (Oseland, 2004).

Oseland (2004) finally concludes that: "The environmental conditions which are considered most important to 'get right' to support the respondents' work activities are: winter and summer temperature, ventilation, people noise, privacy and daylight" (Oseland, 2004: 7). Roelofsen (2002) also arrived at a similar conclusion after doing a literature review study on the impact of office environments on employee performance. He said that the thermal environment and the air quality had the most impact on the workers' productivity in an office environment (Roelofsen, 2002). Additionally, he calls for a unifying human model that evaluates comfort (temperature, air quality, etc.) with respect to productivity. Haynes (2007b) consequently provides one such model with the theoretical framework for office productivity that aims to measure comfort through a multi-item scale measurement of office comfort.

While some authors, including Oseland (2004) and Leaman and Bordass (2005), tried to measure satisfaction with the help of environmental and facility issues, others limited their investigation to any one component and its impact on productivity.

2.2 Organisational concepts

Some concepts significance to architecture tend to operate a group level, for instance, interaction and communication between employees as well as between groups and departments within an organisation. Interpersonal relationships, therefore, play a key role when we attempt to look at what kind of impact they have towards the bigger picture in the work environment.

2.2.1 Communication

The location, as well as the design of the workplace, can promote or present an opportunity for communication (see e.g., Danielsson, 2010).There are however many factors that determine the nature of the interactions in a workplace, these include, sense of control, nature of the work, proximity to colleagues and the access and proximity to meetings and other interaction friendly places.

People tend to communicate less when they don't have a control over the process (Bencivenga, 1998)therefore, the goal of the architecture in companies where communication is important is to deliver a sense of control. However other factors such a the nature of the assignment and the means of communication then come into play, for instance, if the information is regarded as High-complexity then a face-to-face meeting is needed, while otherwise, a phone call or even an email should suffice to convey information (Allen, 1997). Often meetings tend to be spur of the moment and unplanned and unorganized by management (Kotter, 1982) the take place in 'activity nodes' or 'nodes' and are usually face-to-face. The ecological psychologist Bechtel (1976, cited in Danielsson, 2010) describes these nodes as places where people tend to run into one another in an office. A concept quite like the one proposed nu Lynch, 1960, wherein he proposes a need for strategically placed locations where people will have to pass one another and this will mandate interaction. Nodes, on the other hand, are 'primarily junctions, places of a break in transportation, a crossing or convergence of paths' (Ibid. p.

47). Nodes are sort of the focal point in a workplace, like the coffee room, somewhere people interact but it is also at their workstation visual field so they can observe without leaving their own space (Becker and Steele, 1995; Lawson, 2001).

Proximity is one of the key determinants of effectively promoting or facilitating promotions, for instance, less space between workstations provide an opportunity for people to interact. According to studies, the more distance there is maintained between people, the more it reduces the chances that they will interact with one another (de Croon et al. 2005). Since it is important that people contact one another to face-to-face to foster creativity and ideas, architecture needs to promote factors such as proximity to increase chances of eye contact, and in doing so promote the flow of ideas (Allen, 1997). Furthermore, proximity also helps build friendships among colleagues (Allvin, et al. 2006). So, the organisations also play into how well a newcomer into the office environment can assimilate and blend in with the others to reach his optimum productivity. Therefore, keeping the higher ranking members in an organisation physically on a higher floor in the office creates a distance and therefore enforces the hierarchy, however, this distance can also be bad to the prospect of communication between the employees and management (Kivimaki, 2007).

Along the same line of investigation, formal meetings that are organized and planned are not affected by the proximity or hierarchy like the spontaneous one's and therefore it doesn't play as important a role in formal meeting context (Sundstrom, 1986). Furthermore, it is established through research studies that the spontaneous meetings that happen are more profitable to the organisation and that the formal one's are rather overrated in their importance and tend to waste time (Kraut, Fish, Root, and Chalfonte, 1990). They argue that there is inefficient flow of information among people in formal settings. Therefore, taking into account the need to promote more spontaneous interactions for the welfare of the company, this should be incorporated in the architectural designs of the organisations. Furthermore, it is often tempting to lessen space in the communal areas to save money, however, this is where most of the information exchanges and spontaneous meeting happen.

2.2.2 Groups and Teams in an Organisational Context

Teamwork and corporation among employees is a basis of many projects and activities that comprise the day-to-day work in most organisations. In addition to the need for interaction, even the wok density across organisations has increased significantly. However, the teamwork mechanics are still not well understood (Mullins, 2008). There are four contributing factors to understanding teamwork: 1) membership factors, 2) organisational factors, 3) group development and 4) maturity of a work environment. Architecture's role in this is to through its ability or inability to facilitate more interaction among colleagues or team members. Furthermore, smaller groups tend to be more efficient than larger one's in corporations so the design needs to meet the optimum group size requirements. It is, however, difficult to come up with a definite numerical value for an optimal team as this is determined by other factors. However, on average the magic number seems to be 12 such that the team can efficiently further divide into two smaller groups of 6-7, which happens to be the number of members it takes to make a strong group (see e.g., Mullins, 2008). Moreover, the location of the members and visual access with one another among other criteria needs to be considered.

Another researcher, Mitchell McCoy (2000) found that highly creative tend to be more successful when they are more proximity which allows for them to form a better rapport with one another, while other studies show that too much proximity has a negative impact on creativity and productivity (Metiu in Cohen, 2007). Even the IWSP at Cornell University bullpens designed for teamwork and shared workspace tends to foster a relationship and better work rapport among teammates as opposed to cubicles that separate them from one another (Becker and Sims, 2001) in contrast it has been found that employees find it hard to concentrate in open workplaces.

2.2.3 Cohesiveness

There are numerous advantages to cohesiveness - it serves as a buffer to stress and therefore it helps to keep them in good health— if there is a good psychosocial environment at work it makes the process less stressful. Therefore, cohesiveness not only

helps an organisation because it ensures greater employee productivity as a result but it also fosters better creativity and idea making. Furthermore, the potential for success is a big motivator for employees. This may not always be a good thing in the case of teamwork as it may cause several different identities within a group and eventually lead to internal norms, which may not be compatible with the organisation (Sundstrom, 1986). As demonstrated in the Hawthorne experiments on its bank-wiring group, team activities can cause a negative pressure build-up with the group. In some instances, the pressure is sometimes so intense; they perform well below their combined individual capabilities, even after financial and other incentives were offered. Stronger groups often tend to have problems that stem from conflict among the group members themselves. Therefore the art of making well-balanced groups is imperative to organisations Lenéer-Axelsson and Thylefors, 1991).

2.3 Workplace design and employee health

Whitley, et al (1996) tried to widen the debate with regard to the evaluation of the office environment. They claimed that the level of satisfaction was not only limited and dependent on the indoor environment but also with whether or not they were happy with their jobs they wanted. From two office buildings, over 400 employees were surveyed to understand the SBS. The questionnaire went over questions about job satisfactions, environment, etc. they used a 7-point scale to measure satisfaction with surroundings while the perceived productivity is self-reported rather than measured. Interestingly, this is the same scale of reporting that was introduced initially by Lealman and later adopted by Oseland (1999; 2006). The study led to the conclusion that: “Office satisfaction is seen as a primary predictor of sick building syndrome and self-reported productivity. Office satisfaction is significantly associated with job satisfaction and environmental control” (Whitely et al, 1996: 5).

While this study helps us move on from only focusing on the environmental aspects of the workplace that influence productivity to the various other issues like behavioural environment that has been ignored thus far among other limitations of the research to be documented. At first, they conducted the research using subjects from two buildings of the same company however, there was a potential for generalization in addition to the fact that the self-assessment of productivity summed up in a single question on the survey. Another group of researchers tried to understand whether fresh, outside air

affected the IAQ perception and therefore SBS and productivity. They conducted these studies in normally furnished offices "Five groups of six female subjects were each exposed to three ventilations rates, one group and one ventilation rate at a time. Each exposure lasted 4.6 hours and took place in the afternoon" (Wargocki et al, 2000b: 222).

During an experiment conducted where workers were to perform simulated office work, they admitted to feeling nicer when there was better ventilation. Furthermore, all tasks, such as addition, text typing, and proofreading and creative thinking were reportedly improved with increases in the ventilation. The most significant change was seen in text typing to modernise the content in the survey so that it was relevant to the modern workplace, they included a section testing creative thinking (Wargocki et al, 2000b). The results of this survey involving creative thinking in with regard to ventilation were more relevant to the modern workplace since the employees claimed that better ventilation was preferred. In conclusion, good ventilation systems need to be installed in order to maintain a good working environment. However precise it may be, this study does have its limitations because they only conducted the research in one office also using female students, which means there could have been generalization and also a gender bias.

2.4 Productivity

The word productivity is frequently utilized, despite the fact that the meaning and method for estimation still is not well characterized (Haynes, 2007a). Various literary works outline the connection between a few of these variables and the efficiency of the representative. There are distinctive productivity definitions in writing. A result that workers can expect with little exertion is called efficiency (Rui and Pitarma, 2003). Hourly results and nature of said result are known as productivity (Sehgal, 2012). It is something that builds endeavour capacities and general execution and nature of yield (Dorgan, 1994). Rolloos (1997) characterized productivity as "productivity is that which people can produce with the least effort". Sutermeister (1976) characterizes productivity as, "output per employee hour, quality considered". Dorgan (1994) characterizes productivity as, "the increased functional and organisational performance, including quality". Productivity is a proportion to gauge how well an association (or individual, industry, or nation) translates data assets (work, materials, machines and so on) into products and administrations. For some situations, the productivity is measured based on

execution escalation as when there is minimal non-attendance, fewer workers leaving early, and fewer breaks; on the contrary, the upsurge in execution can be measured via quantity of units manufactured per employee every hour.

Simply put, productivity is a financial quota of the effectiveness of production, a proportion of the monetary inputs and yields. Productivity measures can be connected at a large monetary scale; for instance, a country's total national output for every hour worked is a typical method measurement, in addition to the level of an individual specialist concentrated on one task alone.

When one considers productivity in the framework of the working environment, the word has many different meanings and measures. We may look into the productivity measure of one single individual specialist, or perhaps a group of them, or a whole enterprise. Numerous research methods have been utilized for quantifying productivity, including field or research facility studies and target measures (hard information) or self-reported (perceived) measures.

Field studies that try to pinpoint the results of productivity due to the physical environment areee guesswork at best, as target execution measurements in office situations are uncommon and frequently not made accessible because the organisations do not cooperate to discharge aggressive or HR data. Moreover, numerous organisations tend to group sick days and vacation time into the category of “paid time off,” rendering them useless as means of quantification.

The terms performance and productivity are often confused and interchanged. Stringer (2013) proposes a formula for performance i.e. Performance = Ability x Motivation x Opportunity or simply put in words performance consists of three factors – how skilled someone is to handle a task, their motivation to do it, and finally, the opportunity or access to the task for them to actually perform it. This is, therefore, a testament to how complex work has become today, as for the ideal performance, their needs to be the right factors at the right time. So what is the role of the office itself? – Judith Heerwagen (2000) who is working as a program expert with the General Services Administration proposes the following ways in which the workplace can influence output:

- "A building can positively affect ability by providing comfortable ambient conditions, by enabling individual control and adjustment of conditions, and by reducing health and safety risks. Negative impacts on the ability to do work are associated with conditions that are uncomfortable, distracting, hazardous or noxious".

- "A building can positively affect motivation by providing conditions that promote positive affective functioning, psychological engagement, and personal control. Moods create the 'affective context' for thought processes and behaviours and are directly tied to motivation".

- "A building can affect opportunity by providing equitable access to conditions that reduce health and safety risks, equitable access to amenities and compensatory design options where inequities exist and are difficult to eliminate entirely."

There are several ways to measure occupant productivity: physiologically, objectively, or subjectively (Ilgen and Schneider, 1991). Physiological measurements are done by looking into changes in the cardiovascular, the respiratory, the nervous system, and biochemistry of the human body and any changes that occur. However, there are several drawbacks to this: 1) physiological factors are often affected by outside conditions. For instance, temperature changes can cause fluctuations in blood pressure and therefore they need the optimum conditions to gather data; and 2) the act of measuring itself could rattle the subject and produce unreliable results (Meister, 1986).

Measuring the performance on a task basis can allow for more effective objective measurement. There are two types of task performance categories – Primary task performance, wherein productivity is the absolute value of a single task that is performed or comparative task performance, wherein the productivity variation between two or more tasks that are performed is measured and compared. This allows us to obtain numerical results. It is however to make note of the assumptions made in this attempt to quantify the results - the capacity of our brains to process information is limited and therefore this leads to a conflict among the several assigned task for one's time and attention. How accurate these assumptions are will then determine the accuracy of the results we obtain through them results (Meister, 1986). Moreover, it is also notable that there is no best way to measure the comparative tasks in any way (Li, 1998).

Lastly, subjective measurements obtain the subjects' opinion on their level of productivity by through questionnaires and interviews. These become increasingly popular since people are likely to perform the tasks based on their feelings (Haynes, 2008; Li, 1998).

2.5 Workplace design and employee productivity

Nowadays, there has been a reversal of roles in the relationship between employees and employers. Employers, in addition to employees, are now liable to alter and update themselves to keep up with the new pace of the ever-changing global market. HR executives, therefore, need to restructure their recruiting procedures and invest in retraining the employees that are already in the organisation. A good way to attract the suitable employee pool is by offering better compensation packages and benefits. Moreover, other factors such as the office design and other amenities are also incentives that attract newer employees to the organisation and even help to maintain the current one's. It is, therefore, crucial to look into the factors that could potentially impact employee's engagement, productivity, morale, comfort level etc. both positively and negatively (Bluyssen, 2014a; 2014b).

As established earlier, people tend to spend a majority of their time at work, which is mostly indoors, so it shouldn't come as a surprise that the surroundings in the indoor setting would play a part in controlling mental status, mood, and therefore performance (Peponis, et al. 2007). So to ensure desired outcomes or productivity of employees it is important that the indoor environment that they work in would cater to their comfort. Many other studies also explore the factors such as dissatisfaction, cluttered workplaces and the physical environment conducted over many office buildings that prove that it has a negative consequence on worker productivity (de Korte et al. 2015; Vischer, 2007; van der Voordt, 2004).

Organizing workplace tools and accessories so that it allows the systematic and efficient flow of work can be attributed to the field of workplace design (BNet business Dictionary, 2008). According to the National council of interior design Qualification (NCIDQ) interior design as is an artistic as well as scientific means of arranging one's personal space to facilitate one's creative and technical ideology as per their behavioural

requirements. In doing so, they can create a better environment in the workplace and consequently enhance the chances of the organisation's success by increasing productivity. Furthermore, quality also influences the employees' work performance turnover and is known to reduce absenteeism (Hameed and Amjad, 2009). Interior design often also serves as a tool to attract as well as an incentive for employees to stay in the company so much so that the American association of interior design considers the physical environment as one of the top determining factors.

Despite workplace conditions being such a priority in the workplace, many organisations often have quite the opposite issue, with workplaces being less safe, and other numerous issues with health and comfort, improper lighting, ventilation and excessive noise. Consequently, these people working in less than ideal or comfortable conditions present with more health issues as well as more absenteeism and therefore poor performance. This is not an uncommon problem among organisations today. According to Pech and Slade (2006) argued that with the constantly rising employee dissatisfaction, there is increasing pressure to improve working conditions making it the key factor in determining employee engagement and disengagement. Moreover, other studies stress on how the working conditions play a role in the number of complaints organisations receives as well as the number of sick leaves they take. Wells (2000, cited in Leblebici, 2012), states that job satisfaction i.e. through working environment, especially in the case of employees that spend most of their day on a computer terminal, has been a defining factor in their productivity. This especially holds true as there have been more and more computer stations being installed at workplaces since the shift to a more ergonomic design for workplaces. The need for a more human work experience has been credited to contribute to the increasing popularity of ergonomics or biomechanics.

There is a common misconception among executives that the size of the compensation package is the determinant of employee performance, however, it simply serves as a short-term incentive for them to perform (Ryan and Deci, 2000). The idea that better environment leads to better performance is a concept more unanimously accepted. To better describe the office it must be divided into physical and behavioural parts, and then those parts further unto several independent variables keeping in mind that the physical components influence the behavioural one's.

With the improvement in the working conditions, one can expect a 5-10% increase in productivity from the employees. Stallworth and Kleiner (1996) suggest designing the

offices of the company to make the employees more comfortable can serve to raise their satisfaction levels and therefore their productivity. Furthermore, if a company were to be more creative in its approach they can establish a workplace wherein the flow of information among employees, regardless of their position in the company is more free and efficient. The modern workplace, according to Statt (1994), consists of technology, i.e. machines and computers, furniture and other accessories. In order to ensure productivity, the design must be able to establish a balance between interaction and privacy, formality and informality, functionality, and cross-disciplinarily and therefore used a tool to ensure the prosperity of both the employees (Huang, Robertson and Chang, 2004) as well as the organisation (Mohr, 1996).

Whether employees decide to stay with the company and whether they are satisfied with their jobs, and their level of pay and how they perform entirely depends upon inadequate equipment and inadequate working conditions (Weiss, 1999; Wise, Darling-Hammond, and Berry, 1987) and how much the company is willing to do to improve the aforementioned factors. Employee commitment is further influenced by whether an employee perceived they are safe in the workplace as well Gyekye (2006).

2000 employees working for several organisations across many industries were surveyed as a part of Hughes (2007, cited in Hameed and Amjad, 2009) research. Nine out of ten times the survey led to the conclusion that workplace quality was responsible for employee productivity and interest. Furthermore, Roelofsen's (2002) work on the same also produced similar results that indicated a more optimal working environment resulted in lesser complaints and absenteeism among employees. However, the most significant aspect of the environment that impacts the stress and dissatisfaction is the indoor aspects of the design. In the 21st century, businesses are being meticulous when it comes to the design of their environment for this very reason (Govindarajulu, 2004). Yet another research study by Patterson et al., (1997) also led to the same conclusion that the more satisfied employees are more efficient and more productive in a workplace. Sekar (2011) proposed the idea that the work itself, along with the workplace and the tools of work come together comprise a key component of work. To optimize work output, there are two things that management tends to focus on – personal motivation and infrastructure (Sekar, 2011). While it has been established beyond a doubt that many aspects of the environment contribute to productivity, Haynes (2008) argued that the behavioural aspect is the strongest influence through interactions resulting in the most positive outcomes and

distractions resulting in the most negative. Since people are considered the most important asset of an organisation, effectively managing them has become of utmost importance (Patterson et al., 1997).

Yet another group of 2000 employees was studied as a part of Ajala's (2012) and presented with similar statistical results. However this time the study found that nine out of ten of the cases employee attitudes were the factor that was influenced by the environment and this, in turn, determined their work. Workplaces that are designed keeping in mind the needs of the employees and designed to their convenience tend to motivate employees and therefore increase their productivity while also resulting in lesser issues on the matter (Amina and Shehla, 2009). The workspace has such a strong influence on employee attitude that it could potentially boost employee performance up to 19% and management performance by up to 17%. This is not the only study to present with these results; Gensler (2006) presents results to a similar study wherein he found that 90% of the employee participant agreed that the interior design and office environment somehow seems to impact their work.

Organisations that have been altering their designs to be more employee-oriented have been known to have higher productivity. Many researchers credit this to a combination of the right physical space combined with effective managerial practices (Leaman and Bordass, 2005; Uzee, 1999).A private research firm named Gensler, conducted a survey of over 2013 subjects in march 2006 and found that 89% of employees marked design as a factor that is 'important to very important' in a workplace, meanwhile 90% of higher ranking employees also responded that better design leads to more productivity, therefore, leading to the same conclusion that the business could better their output by as much as 22% as estimated by management, simply by improving on their design. Even after so many studies confirm this fact, many companies still do not pay as much attention to the design aspect of their offices. As many as 40% employees report that they believe that their offices end up being badly designed as a means of cost-cutting and over 46% of employees claim that improving this isn't a priority for the companies at all and this is evident in the result of the survey wherein employees rated their workplaces as 'fair to poor' and the 90% that reported a negative impact on their attitude as a consequence and if this weren't enough evidence, 89% reported dissatisfaction as a result of their work conditions (Gensler, 2006).

A similar study was conducted by the American Society of Interior Designers (ASID, 1999), which found the design to one of the major factors that determine output and job satisfaction. They found that only 31% people had satisfying jobs and were content with their environment while 50% of the people surveyed were in search of new employment and listed design as an important deciding factor. Brill and Konnar (1984) tried to list the factors in order of their most to least impact on productivity and their list consisted of furniture, noise, flexibility, comfort, communication, lighting, temperature and air quality. Springer Inc (1986) attempted to study the association between dissatisfied employees and their productivity in relation to the indoor environment where they work and they found that people were often unhappy with the light, temperature, air quality among other things claimed that this affected their productivity greatly.

2.6 Different perspectives on workplace design

2.6.1 Environmental psychology

Through physical stimulus, the environment interacts with an individual and the field of environmental psychology deals with trying to understand this interaction. It is often defined as: "Environmental psychology is the study of the interrelationship between behaviour and experience and the built and natural environment" (Bell, Fisher, Baum, and Greene, 2001, p. 7).

It is particularly challenging to understand the human behaviour for many reasons, for instance, there is a complicated level of interaction between a person and his surrounding, while there is also the interaction a person has with other people in this setting i.e. colleagues and superiors. So that goes to show that even if the surroundings are unchanged, the type of interaction we have in their context tends to alter our perception toward them accordingly. So, in a workplace, our perception is quite significantly influenced by the hierarchy that exists within an organisation, which influences our physical stimulus in coherence with our environment. Yet another factor in play is ownership of the space, when we at home, even if the environment is the same, we own or are contractually habitants of the space, and with ownership or even a legal contract, for that matter, comes a sense of control over the space we cannot achieve in a workplace wherein the organisations ownership is unambiguous. This type of interaction

is what is studied through environmental psychology. Yet another notable way that environmental psychology is defined as "the study of the interrelationship between behaviour and experience and the built and natural environment" (Bell, Fisher, Baum, and Greene, 1990, p. 7).

While environmental psychology focuses on the impact of the design on human perception and behaviour, architecture simply deals with how space is designed, but they do share the aspect of design in common and being the important common denominator that it is, this makes their association an important one. Environmental scientist Evan's gives us an example of the types of issues the field is trying to explore: "How are places developed, how do they acquire meaning to people, how are they related to people's action, their preferences, and even to their emotional reactions and well-being? And what does the concept mean across generations or across cultures?" (Evans, 2003: 4). Over time environmental psychology has moved away from architecture, however in earlier research by architectural theorists Hesselgren (1986) and Lynch (1960) as well as by architectural psychologist/ environmental psychologist Canter (see e.g., The psychology of place, 1977) this relationship is quite obvious.

As they grew apart, environmental psychology has become more focused on the mental and behavioural consequences seen as a result of one's environment. Another area of environmental psychology, a post-Hawthorne one (whose theories are discussed later), deals with the physical aspect of a space in a workplace, taking into account the individual as well as the organisational context. The Sundstorm table, presented later, explains how environmental psychology plays into other fields of psychology.

The process that goes into studying the influence of one's environment in an individual capacity is a complex one as this may present directly or indirectly in a mediating or moderating capacity which makes it difficult to set them apart. Therefore, before understanding the relationship between a subject and their relationship one must understand the subtle distinction between mediation and moderation. Mediation process seeks to point out an observable pattern to the relationship between an independent variable (the predictor) and a dependent variable (criterion) through a third variable called the mediator variable (MacKinnon, 2008). The mediator variable served to understand exactly by what means they are related and to what degree there is causality, if any, between the dependent and independent variable. The moderation process, on the

other hand, attempts to point to a time or condition under which a particular relation or association between the predictor and criterion hold true (Beaubien, 2005).

2.6.2 An Occupational Health Approach

Social and stress medicine consists of a subdivision called the occupational health that focuses on the psychological and physiological demands of work with respect to one's health. The association between architecture and health may not be as obvious or may even seem like a bit of a stretch but the repercussions of the environmental psychological influences cannot be ignored. Ignoring the impact of one's office space would leave my thesis incomplete at best and irrelevant at worst since it is such an important contributing factor to employee well-being. But regardless, discussion of this topic serves a greater purpose than self-interest, as it has become a socially recognised problem, for instance, the increased instance of self-reported illnesses in Swedish workplaces (Krantz, 2003; Lundberg and Melin, 2002).

With people starting to live more individualistic and single household lives, the work environment being a big part of their life and time spent, the psychosocial aspect of it has become of utmost importance toward their mental and physical health (Lenéer-Axelsson and Thylefors, 1991). According to studies, the psychosocial influences on individuals translate to their cardiovascular health and are also associated with numerous other diseases and systems in the body. Therefore, if one's psychosocial environment is not ideal, it is likely to result in more absenteeism for health reasons in organisations (e.g., Hjemdahl, 2003; Karasek and Theorell, 1990).

Like we established before, that over 50% of the western population works in office buildings and this proportion is only getting larger (Duffy, 1999). We also mentioned that mental health is the leading cause of sick leaves in Sweden's working class in the recent years (Åsberg, Nygren, Rylander, and Rydmark, 2002). Combining the two statistics only serves further as a testament to the importance of considering mental health at the workplace. Considering that the physical aspect of work is associated with the psychosocial one, therefore it is not a factor to be ignored.

People are constantly under stress at work, and this can be a negative influence on them at and outside of the workplace. For instance, this translates to higher demands to achieve

and therefore a faster-paced life (Krantz, 2003; Lundberg and Melin, 2002). However, it is important to consider that stress is a very multifaceted factor in that some amount of it is actually considered beneficial to people and not forgetting that inactivity can also lead to bad stress. In the battle between those that thrive under this stress and those who are negatively impacted by stress, it calls for a change in focus from what makes people more or less stressed to what could potentially be an "unhealthy" environment or situations that impact employee health and productivity. Therefore the research has evolved from focusing on factors that repair the effects on stress to assuming the absence of stressors is what reduces stress (Hartig, Böök, Garwill, Olsson, and Gärling, 1996). Evans hypothesised that there is something about the right architectural design that can cause a therapeutic sort of reversal of stress. He explains by stating that these would be aspects of design, which promote inquisition and curiosity among other mental processes to rejuvenate someone mentally such as fireplaces, plants, aquariums, animals, or paintings and colours embodying the feeling of calm and relaxation.

Because everybody reacts to stress differently, there are several models developed to observe the response of people to stress. When trying to describe or depict stressful situations for the subjects, researchers are often tempted to describe the archetype situations we describe as stressful, however, with the new models they use the description of the environment to take a route that may be common to all subjects and more general. There are three notable models, two of which have a psychosocial take, these are, the Demand-Control model by Karasek and Theorell (1990) and the Effort-Reward Imbalance model by Siegrist (e.g., Kuper, Singh-Manooux, Siegrist, and Mamot, 2002; Siegrist, 2003) while the third model developed by McEwen, called the Allostatic Load model takes a more biological approach.

Each model has been summarised briefly below:

1. The Demand-Control Model – this works on the principle that when the demands of a job are too high for a number of resources available to an employee, so much so that they perceive that they have no control over the situation, then stress is induced.

2. The Effort-Reward Imbalance Model – according to this model, if a person does not get the expected recognition or reward for the amount of effort they put into their work stress in induced.

3. Finally, the Allostatic Load Model – this model states that if there were to be an imbalance between allostatic systems, which is created by over/under activity, then this impacts the health of a person negatively. McEwen also adds that stress itself is not harmful but it is how someone reacts to a stressful situation determines the outcome on their health. If people are more likely to cope in a healthy way, they are less likely to have stress-induced problems.

It is important to keep in mind that stress diseases are influenced by factors such as sensitivity toward stress, which is in turn, influenced by the individual themselves as well as their gender. For instance, women are more affected by stress than men (e.g., Chesney and Orth-Gomér, 1998; Orth-Gomér, 2003). One possible explanation for this is the added responsibility of the household for women in many cultures in addition to work, therefore women in the same position as men are often found to have higher stress levels (Lundberg and Frankenhauser, 1999). Furthermore, when men come home after a workday, they are relieved of their stress while the stress level of women is interestingly raised. However, an argument can be made for the opposite as women can face benefits from being needed in both their roles. Another significant distinction is that women turn to medication to cope with stress while men to alcohol (Krantz, 2003).

2.6.3 An Architectural Approach

Architecture is a field that embodies art and science to create buildings and other structures. External structure, interior design, landscapes and even urban design are a part of this field and it comprises anything that is constructed by human beings. And although architecture deals with the physical, it seldom pays attention to the environmental aspects and when it does, it is often from an aesthetic or professional standpoint (Collins, 1971; Holm, 2006). There is hardly any research done on the subject of office design and how it may affect their inhabitants. What little research is done is limited to one of the following fields - organisational-oriented research (e.g., Duffy, 1999; Söderberg, 1993, 2003), communication oriented research (e.g. Penn, Desyllas, and Vaughan, 1999), spatially oriented research (e.g. Peponis and Shpuza, 2008), and workplace planning oriented research (e.g. Ahlin and Westlander, 1991).

While office design is constant changing with trend both externally and internally, it is often only changing to efficiently keep up to date on the trend and seldom considering the employees. Some of the leading work in organisational theories done by Fredrick Taylor and Henri Fayol, for instance, have led to some significant improvements in office design, of this, Taylor's scientific management' is considered the most prominent (Duffy, 1999) as it embodies the hierarchy of the workplace and control of the employees who are often mistrusted by the higher ups. To summarise the process, a combination of organisational and management theories were blended together over time and they designed the offices according to the development of telecommunication (e.g., Ahlin and Westlander, 1991).

There are two major notable styles of architectural design for the workplace—the northern European tradition and the North American tradition (Duffy, 1999). Countries like the United States, Canada, the United Kingdom as well as the Pacific Rim cities such as Tokyo, Hong Kong etc use the Northern American style. In doing so they are more concerned with management and efficiency and office buildings symbolise economic strength and prosperity. This type of style has been prevalent in the corporate world internationally. While the Northern European style is seen in the Nordic countries but also the former West Germany and the Netherlands. This style prioritises site location and the work environment. This style probably evolved in response to the various labour legislations that permits the employees´ co-determination at the workplace in the countries within this office tradition (Duffy, 1999).

In 1913, Taylor's book on scientific management considered the bible of office design was published. Later, there were other books on office design that gained importance, such as Leffingwell´s book 'Scientific Office Management' published in 1917 and Galloway´s book 'Office Management, its Principles and Practice' published in 1918. The goal was to use a general set of norms that could define all the work done at any workplace and then using that they could rationalize the work by 'office automation'.

They introduced 'Bullpens' during and after World War I, these were large open spaced areas wherein routine-based work was performed under the watchful eye of management through and was also guided by them. They also introduced 'cell-offices' and these were places wherein more skilled work was to be performed by more accomplished people. The rationale behind this design of the office was: 1) shortage of manpower and thus a need to rationalize clerical work, 2) administrative work's increasing popularity in the

business world; and 3) women´s entry into the workforce (Ahlin and Westlander, 1991). As the work became less mechanical, clerical work status began to decline in the hierarchy of workplaces.

They promoted the idea of an office as a large space with many workers under the supervision of one manager especially for clerical work and the woman workforce. This was a result of an analytic and engineer-like approach toward architecture at the time. Progress in career went hand in hand with design, after a pattern of work was done, people would be rewarded what they deserved.

During the 20th century, an architect's priority was hardly the employee convenience or comfort but their interest was on flexible plan layouts. Consequently, there was less than ideal situations created and people soon began to protest against this design. Even the architects by the 1930s were in support of a more individual cell-office-divided-by-corridor based design for the office with the central area for other amenities as opposed to the flexible plan layout.

Howe and Lescaze designed the Philadelphia Saving Fund Society Building, the first of its kind, International style skyscraper built in the United States. The building was a trendsetter to a new era in office design, very distinct from the Bullpen-offices. PSFS Building was designed keeping in mind how the paper works its way through different departments of the building. The individual offices were designed to have ideal lighting and ventilation and were big enough depending on the work that was to be done in them. Additionally, the employees had access to good service facilities such as food and dining areas and gyms, etc., in common areas. The PSFS Building changed the office design globally in two major ways: 1) height of the building now became the symbol of prosperity and avant-gardism and 2) office work now became an individualistic concept – like the cell offices – in one's own space. And that is how design and rationale for work came together.

2.7 Changeable World with New Conditions

It is important to consider the change in the market in the 20th century when considering the context of office environments and their influence on employees and organisations.

There has been a shift from the industrialism to a more global labour market and as a result, there have been many changes that came along in an organisational point of view.

Nowadays, the workforce is synonymous with products, and like products, they are disposable (Braverman in Allvin, Aronsson, Hagström, Johansson, and Lundberg, 2006). And therefore we see things like lower salaries when the supply of workers are greater than the demand, and therefore companies find it more beneficial to offer a more temporary contract based employment to their employees. However, there is also a parallel universe of organisations, where there is more traditional management practices such as planning and executing work and then that is passed along to the group based workers and then to the individual levels. This method, even though limited to consultancy and IT companies has gained popularity worldwide across companies (Allvin et al., 2006). With the new demands of the market, employees volunteer to handle more work on their own to 'survive,' and are also expected to: a) keep themselves updated to raise their demand in the market, b) network and maintain their own contacts, and c) cater to their clients' needs and to not lose them. It has now been christened the 'Knowledge Society' although a more fitting term seems to be 'Service Society' based on the services they offer their clients.

With this entire shift in weight in society, the pressure it puts on the organisations and individuals is greater than ever. A greater portion of the work in this Knowledge Society is office work, which requires quite a bit of mental endurance, which can be stressful for people. For instance, sometimes there is a great deal of work to do but there are no clear cut expectation or instructions given as to what is to be done. In such cases, people often tend to have work on their mind at all times and are unable to take a mental break from it and shell out some spare time and this has adverse effects on their health. Moreover, the majority of the time we spend awake involves mental work and therefore we are awake more just to cope with the amount of work we have to do. Researchers have coined a new term for this new stress i.e. 'techno-stress'.

Newer technology has closed the distance between people and has been game changing in the business world (Johansson, 2002). Like any other advancement, there are several drawbacks to these advances in the information and communication technologies (ICT) however at the same time they provide 'flexibility by trust' by allowing people the convenience of distance working (Allvin et al., 2006). It is a no-brainer conclusion to draw that this is very beneficial to one's family life. In order to keep up with the demands

of the market and Knowledge Society requires a unique and innovative approach to staying afloat which ultimately falls on the employee's ability to do so. Furthermore, at the rate at which these changes happen, and organisation must be ready at all time to adapt with equal speed and efficiency.

While there is all this change coming upon people in the last decade, it has also led to a more prominent role of office work in the day-to-day lives of employees and it has become the new normal for the society; a result of spending majority of time in a day working (Mustard, Lavis, and Ostry, 2006), and today, majority of the work we do happens in the office (Duffy, 1999). Moreover, the concept of leaving your work behind at 5 o'clock is far behind us especially with the prevalence of telecommuting, also called home-based telework has redefined the role of the office in the context of work. And now, the office is become more of a base to meet other employees and exchange ideas and information - a home in itself.

2.8 Different theories on workplace design

Taylor, who published 'Principles of Scientific Management', while working at Bethlehem Steel Mills and the Ford Industries assembly line, developed a theory to the more efficient way of handling work. Through this, he promotes several organisational practices in order to go for the more specialized workforce for routine based work to make the work more efficient (Spector, 2006). Yes, scientific management is of important however it is important not to ignore the work done by Fayo a French based theorist who recognized that management plays a key role in determining the success of large corporations. He said that there should be a vertical and horizontal order maintained in an organisation, and this can be done if individuals were to do as told by the organisation and its management. These two theorists are credited with the 'invention' of management rules that dominated the workforce in the 20th century (Allvin et al., 2006).The interest in the physical environment in the office stems from an interest in ensuring: a) supervision of the workforce (e.g. direct surveillance and monitoring of the employees) and b) the coordination of work.

The well-known Hawthorne Studies conducted in the Western Electric Company from 1924-1932 is deemed one of the most important of them all. The researchers found that

the organisational life played a great role in the results of the employees at work. The most notable study was focused on lighting at the workplace (Roethlisberger and Dickson, 1939). This results showed an alteration in the moods of the people corresponded with the changes in environmental conditions around them. For the increase in productivity observed, they gave credit to the fact that the subjects were aware that they were being watched by the management thus serving as an incentive for them to perform better. This was later christened the 'Hawthorne effect' (Spector, 2006). Because of several methodological and other contextual reasons pertaining to behaviour studies, there has been much criticism against the Hawthorne studies, particularly that they isolated from the social and physical context. Now, the factors like social and physical context. Instead, the social context, including group influences, social status, informal communication and other rules are now embodied in the architectural design (Becker, 1981; Sundstrom, 1986).

There is the Two-Factor theory by Herzberg, which aided in looking at architecture through the eyes of the employees. It plays an important component in Herzberg and his colleagues' theory from 1959, presented in the book 'Work Motivation' (2003). The theory separates factors that result into the motivators and satisfiers, which translate to job satisfaction and motivation to work and the dissatisfiers also known as the hygiene factors as hygiene is an important determinant of satisfaction among employees. However, simply improving hygiene while failing to address other concern with respect to the environment does not improve performance. In addition to good hygiene, they need other incentives to motivate them to work better, for example, interesting work assignment, better leadership and communication provision, etc. (Spector, 2006). So then we are to understand, that unless the employees are not already dissatisfied with their condition, architecture is not a very significant factor. i.e. it can only make things better for already dissatisfied workers, not for one's who are already content.(McCoy, 2002). However, despite the controversy surrounding the theory, it is credible through a) incorporating architectural issues in organisational theory, b) it has potential to improve job conditions in many companies, but c) and most notably because it is what forms the basis of the Job Characteristics Theory by Hackman and Oldham (1976).

According to Sundstrom (1986), Maslow, the popular psychologist incorporated architecture in his famous human behaviour theory, however, this wasn't in the context of the workplace. In summary, his theory states that each person has their own hierarchy

of needs, this also means the need for social relationships and personal growth and the physical environment and the obvious need for basic need for shelter and security (Maslow, 1943). Where Maslow's theory overlaps with the Two-Factor one is that they both agree that only after the basic needs are met, does an individual go ahead to meet their other needs. What sets them apart is that in Maslows' theory, workplace only comes into play if the basics are met, however in Herzberg's theory only if one is dissatisfied with their workplace does it become a significant factor, and otherwise it plays no role in being optimum.

There have been more theorists that have not been mentioned in this review that found that design architecture is an important factor in the environment of the workplace. The Sociologist, Weber, state that in a workplace, where one's position is determined psychologically through their perceptions, architecture plays an important role in establishing this (Sundstrom, 1986). The Hawthorne studies began this human relation movement by introducing the idea that interactions can be facilitated through the right design in the workplace, therefore bringing the significance of interpersonal relation into light. (Sundstrom,1986). E.g. the social theorist Homan considers the environment as a part of the technological component of an organisation. He studied open plan offices and found a relationship between architecture and patterns of interaction in the workplace.

The following table summarizes the different psychological approaches in better detail:

Field of psychology	Application/Approach + Level of analysis + Type of Model
Pre-Hawthorne Applied psychology	- Ambiance- temperature, noise, lighting - Analysis at an individual level -Mechanistic/deterministic model for person-environment interaction
Post-Hawthorne Industrial-organisational psychology of job satisfaction	- Physical environment - Three levels of analysis - Individual, interpersonal, organisational - System models (especially socio-technical system)
Human factor psychology	- Equipment design for ambiance - Analysis at two levels – individual and interpersonal - Inverse of the person-environment interaction + deterministic model (sometimes)
Environmental psychology	- All environmental aspects - Analysis at two levels – organisation and interpersonal - psychosocial and ecological model

Table 3: Approaches to the psychology of the workplace. Source: (Sundstrom, 1986)

The psychological theories above are divided into pre- and post-Hawthorne studies according to the timeline. The field of applied psychology focuses on the individual analysis and focused on ambient factors is considered a pre-Hawthorne. The industrial organisational psychology emphasizes the physical environment as a motivational tool to an individual as well as the organisation and this is a post-Hawthorne theory like the Human factor psychology, which in contrast takes a more technical approach with an

emphasis on equipment design and ambient factors. Mostly they use individual analysis and sometimes even an interpersonal one. Yet another post-Hawthorne, the environmental psychology focuses on the total environment employs a more wholesome perspective, incorporating the individual psychological, interpersonal as well as organisational levels of analysis that we can see depicted in their models.

Theories on Effectiveness, Performance, and Creativity: In the 70's and 80's Steele (1973), Becker (1981) and Sundstrom (1986) began to look into architecture's influence on work through variables like security, social interaction, symbolic identification, task instrumentality, gratification, and growth. According to Becker, the right architecture can promote a healthy workplace by creating an environment-support-system like effect. It can do so by influencing the employees directly or indirectly, intrinsically or extrinsically. Furthermore, he recognized the role that design can promote social interaction and communication and through this, influence their performance.

Below, is the Becker's model of the physical setting's contribution (i.e. architecture) demonstrating its effects to employees as well as the entire organisation:

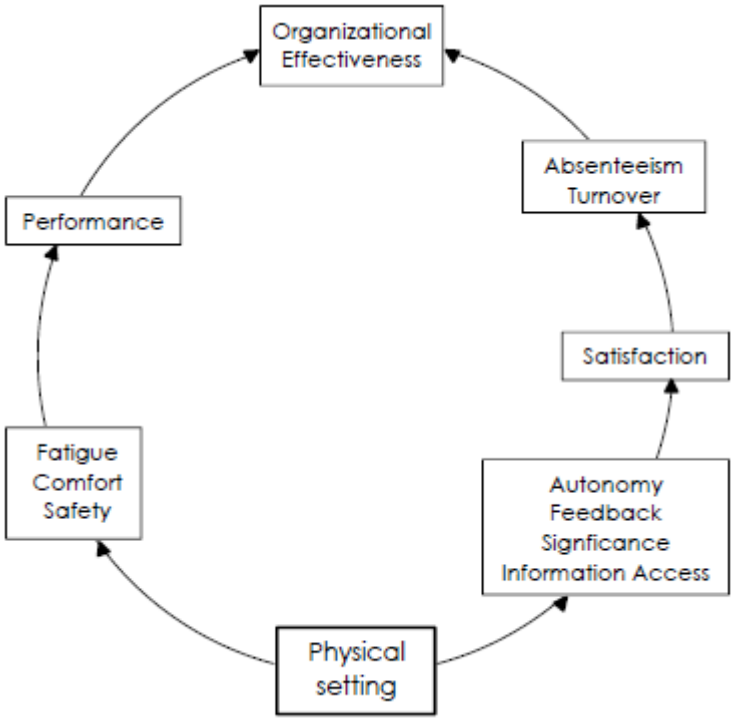


Figure 4: Model of the Physical Setting's Contribution on Behaviours Model of the Physical Setting's Contribution on Behaviours. Source: (Becker, 1981).

Becker and Steele (1995) in their search for the exact means by which the design causes an effect to enable a higher performance of employees described a 'dense web relationship' between some of the factors, which include space, technology, demographics, culture and other work related processes into a concept that they termed 'organisational ecology.'

Sundstrom (1986) took a three-dimensional look at the workplace i.e. individual, interpersonal and organisational in the context of architecture (they physical layout, design, etc.), various outcome scenarios (satisfaction, teamwork, effectiveness) and finally in the context of the motivating processes (status, stress, attitude, etc.). When looking at an individual level, he focused on factors like workstations and job performance, in contrast, when investigating on an interpersonal level, he looked at office layout, communication, other team related factors. Even though there is no evidence to support this theory, there is enough credibility to assuming that individual satisfaction, communication and how the office structure supports the former factors and in unison these create a profitable workplace. Additionally, Sundtrom (1986) found that people who are more satisfied with their working condition are likely to perform better (Sundstrom et al. 1980; 1994).

There has been increasing pressure for organisations to get creative in order to be able to survive in the new and ever-changing competitive global market and this calls for a more creative approach (Allvin et al., 2006). And therefore the interplay between architecture and its behavioural benefits calls for more research into the matter. For instance, the work by Mitchell McCoy, an interior designer and environmental psychologist who studied the allocation of workspace for creative teams in large organisations with regard to the level of satisfaction of the team members and their results (McCoy, 2000).Being more creative helps organisations cope with sudden changes and this is addressed in the International Workplace Studies Program (IWSP) at Cornell University under the supervision of Becker (Becker, Sims, and Schoss, 2003).

The Interaction between Architecture and Organisational Structure: In Porras and Robertson's model (1992) which describes 5 key factors that they claim makes the architecture of great importance to the success of a company. According to them, architecture represents the message or the image an organisation wants to convey to its clients and employees. Their model, however, disregards employee satisfaction and adopts a more 'big picture' kind of approach. They focus on five factors, vision, social,

technology, organisation arrangement, and physical setting of the workplace and how these factors can influence their short or long-term goals. While some of these factors can be controlled like the organisational one's, the physical setting or layout and the technology while others like the social interactions and communication one's are more individual based and therefore can't be controlled though external alterations as easily. The following figure explains the interrelation between the different factors in their model:

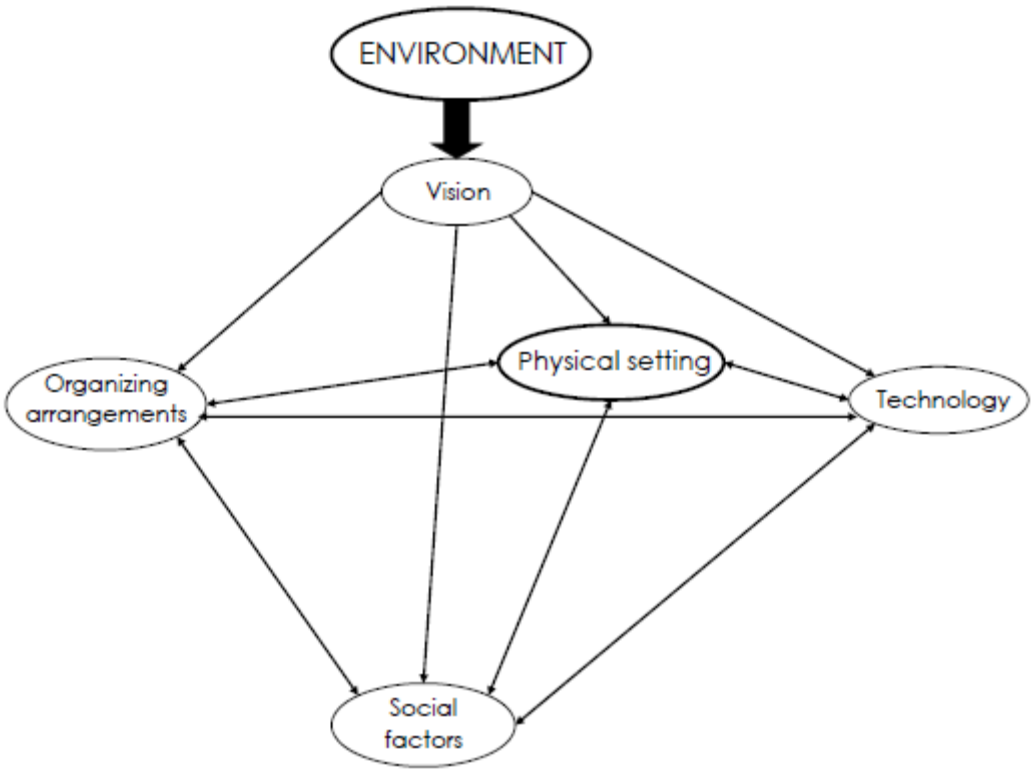


Figure 5: Factors Constituting the Organisational Work Setting. Source: (Porras and Robertson, 1992)

Söderberg (2003) a sociologist and architect, who has used Porras and Robertson's theory in her own work writes that space has the potential to facilitate work or serve as a roadblock in the path to efficiency. Porras and Robertson's recommendation to includes the vision and goals of an organisation and incorporates these into the architecture makes for a very helpful suggestion. Duffy, another architect, worked hard to incorporate the structure of the organisation in his architectural designs (Duffy, 1974a, 1974b). Bureaucracy and interaction which he claims are two qualities of a company are often translated into two qualities of the workplace environment – differentiation and subdivision.

2.9 A Holistic Approach to Office Design

Therefore to design the office shouldn't be as simple as we have been assuming but a project involving data from various fields about the impact of one's environment on their work and how this environment affect the different aspects specifically on an individual level. This, therefore, calls for a more multifaceted approach to creating the workplace. According to Lenéer-Axelsson and Thylefors (1991), we can divide the types of environments at work into the following types:

- The physical - The actual surroundings of people at work.
- The organisational - Whether space allows for organisational interactions among colleagues effectively.
- The social – where other informal interactions take place among employees.

Architecture, organisational-oriented research, environmental psychology and occupational health blended together are considered the ideal approach to office development. Since we are trying to broaden the lens with which we are looking at these disciplines working together we only look at them in an organisational context for the purposes of the research. Furthermore, environmental factors and stressors are discussed as they determine perception. And these are looked at from an individual as well as at a group level depending on their character. When thinking about the extrinsic factors at the workplace, we can cover a variety of aspects and factors and topics, however, it all begins with the influence of the architecture on the employees. Some aspects may be discussed only briefly and may be of more importance than they seem and these are later discussed in greater detail in other parts of the thesis, these include the case concerning some of the environmental factors as well as the discussion on Davis' framework (1984) of physical setting variables influencing behaviour in organisations. Similarly, some of the factors are not discussed at all despite their relevance from a health point of view, as they are beyond the scope of what this thesis is trying to accomplish, these include and are not limited to risk factors such as pollution (pollutants) and bad air quality.

2.10 Environmental influences at workplace

Our environment exerts external stimulus, which has a psychological as well as the physiological effect on us, this is also true in the case of the office environment. However, considering the number and complexity of interactions in the workplace, for instance, between an individual and their surroundings or an individual with their colleague or team, it becomes a challenge to investigate exactly how this is impacted, if at all, by a stimulus. Another hurdle in the way of deciphering this issue is that employees who work for a company tend to associate a lot of emotion with their positions and jobs, being that they are their livelihood and the amount of time they spend there. However, the organisation looks at the workplace with the perspective of proprietorship and control (Mazumdar, 1992).

A Framework to Understand Environmental Influences in Offices: Davis' framework (1984) serves as a great icebreaker to the issue of how environmental stressors influence employees as it describes the interplay between these factors. The framework divides the architecture, into three categories: 1) physical structure, 2) physical stimuli, and 3) symbolic artifact this division plays a simple groundwork for the relationship these categories have in the organisational context. See the following figure of Davis' framework.

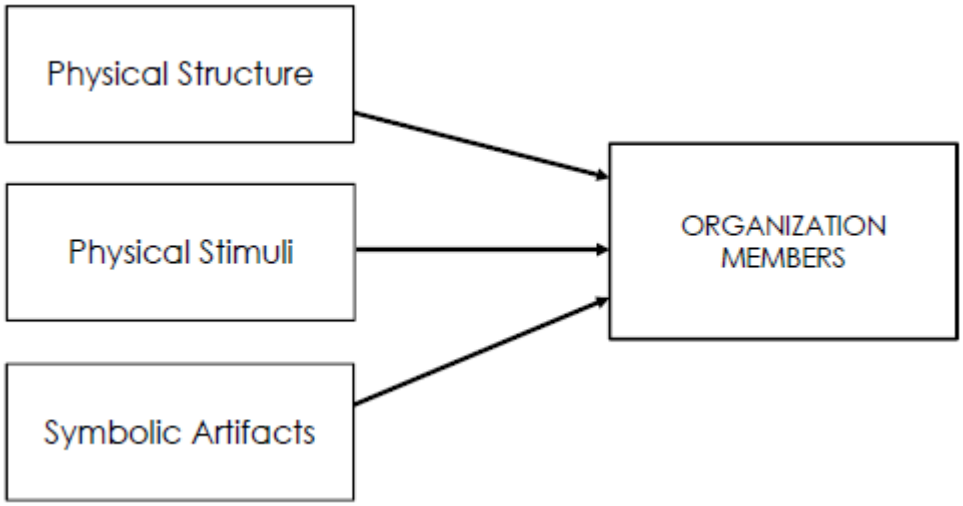


Figure 6: Physical Setting Variables influences Behaviour in Organisation. Source: (Davis, 1984)

'Office Experiences' section of this thesis gives a better description of the environmental stressors and factors according to Davis's framework.

Physical structure: It can comprise the interiors of the office or just the physical structure of the space and whether it is conducive to social interactions– communication, group arrangement, privacy, etc.

Physical stimulus: it is a term used interchangeably in environmental psychology with something that exerts a physical stimulus. Here, it is the term Davis uses to describe something that diverts the awareness and influences employee behaviour in either a positive or a negative way. If negative, it leads to dissatisfaction and mediocrity in work. These can include things like people having conversations, things moving about, phone's and emails constantly beeping, even the supervisor and sometimes this can be a result of simply too many people around them (crowding). This means that the more people there at in a workplace, the more chances that one or many of these activities are happening simultaneously at the workplace (e.g., Sundstrom et al., 1980; 1982).

Physical reactions and behavioural changes are common responses to physical stimulus in the environment (Porter and Lawler, 1965, cited in Danielsson, 2010). The interaction between an individual and his environment can be assessed based on their level of consciousness, adaptation, fatigue, stress, safety, and security. On the other hand, we use the measure of the amount of communication and other exchanges, happening around the office to assess a group of people (McCoy, 2002).

Symbolic artifacts: Artefacts are object help us form an opinion or feeling about our environment consciously or unconsciously. They can be a part of the design or the type and arrangement of the furniture used, the colour of the walls or the use of wallpaper, carpets, photographs, magazines, certificates, etc. things that all come together to form the image or message about the organisation they are representing. Symbolic artifacts serve as status cues to form the image of organisations and there is a field called design management that deals with understanding their role.

Symbolic artifacts talk to their observers/user and are often left to the interpretation of their observer usually intentionally. Often people are oblivious to their effects (Ibid.). because of the existing hierarchy within most organisations status plays a crucial role, and therefore everyone consciously or unconsciously knows where they fall in relation to others on that hierarchy. The symbolic artifacts among other means are used to determine

the status in the office. Duffy (1978) reviewed several office spaces and found that the difference in spaces that individuals occupy in the workplaces serves of establishing hierarchy. Sometimes artifacts are used to help process change in the workplace. When something is removed from its usual place in the office, it then causes a sense of uncertainty among the workers as if something were missing. It can also reduce the hierarchical position in this way (Mazumdar, 1992). Status obviously seemed to have some sort of psychological significance in the workplace and how one perceives their own and impact job satisfaction greatly (Davis, 1984). The impact of artefacts is especially prominent in banks and law firm kind of setting which are not only hierarchical in their nature but also have a side to them that is service and client oriented.

2.11 Perception of environmental factors

Environmental factors are associated with many psychological concepts and therefore it is important to establish whether these are going to be looked at as a threat before each of the environmental stressor is discussed in more detail.

Personal control: How a person perceives the different factors and stressors of the environment is dependent on personal control, thus playing a key component amongst all concepts. It is essential to commence the discussion on personal control, as it is associated with concepts linked with perception. Having a sense of control of one's own surroundings helps to a better mental health and one feels better. When it is, then helplessness may occur (Banduara et al. in Evans, 2003).

How much control an individual has or their self-sufficiency determines how effectively they are able to control the outcomes. Personal control has three main components to it: 1) behavioural (action), 2) cognitive (interpretations) and 3) decisional. There are many proposed theories as to how one strives for personal control at work through psychological and physical reinforcements (Lee and Brand, 2005; O´Neill, 1994; Veitch and Gifford, 1996). The psychology is reinforced when one feels confident and self-sufficient enough to participate in the work activities and motivated to do so. Architectural design can also help physically reinforce or thwart personal control. The factors that influence the level of social control include size, location, and permeability of rooms. However, there are some features of architecture that inhibit this like: large

structure; long interior corridors; lack of rooms for privacy, concentration, group, and teamwork. Evans (2003) suggests that poor visual surveillance hinders the control and feelings of territorial ownership. Evans and McCoy (1998) suggest that the ability to control and personalize the work environment is implemented in the design process, thus reinforcing personal control of each person. Some researchers believe that personal control plays a characteristically significant role of humans in their want to utilize personal control of their environment. (see, for e.g., Rothbaum, Weisz, and Snyder, 1982). Factors such as workspace privacy and crowding are very important in achieving effective employee outcomes such as job satisfaction. This is established by the experience of control and influence at work by an employee according to Carlopio and Gardner (1995).

Clausen and Wyon (2005) suggest that the idea of individually being able to pick and improve ambient factor plays an important role in positively affecting the acceptability on the general indoor environment. Personal control also plays a, important component in encouraging creativity, as freedom and control at work, shows to help stimulate creative teams, as suggested by McCoy (2000).

Privacy: The term has a broad description like the need for psychical or visual space, according to environmental psychology this is done by establishing a mental separation successful through a lesser densely occupied space (Haans, Kaiser and de Kort, 2007). Privacy helps to fulfill a person's self-identity and is described as one of the major functions it plays by researchers (Kupritz, 2000; 1998). Moreover, the need for privacy can be very dependent on individualistic and cultural factors. In order for a person to be able to control and handle the stress exerted by the environment, privacy is also categorized as a coping strategy. In teamwork or group activities it is a critical element when it comes to communication. Research looks at privacy as physical and visual privacy and these can be achieved by establishing obstruction from others, and distorted if suddenly people appear in one's private space. Sundstorn (1986, cited in Danielsson, 2010) proposes three core ideas of privacy – physical separation from others, control over information and interactions.

With very little interaction faced by a person, it may lead to isolation whereas too much interaction can cause crowding as suggested by de Croon et al. (2005). Due to the significant amount of work and sharing of facilities and workspace with other employees, privacy plays a key role in office environments. It is important to attain an office design

that balances accessibility and physical separation amongst employees. Finally, it is important to fulfill the employee's criteria of office environment as follows for them to be able to work: 1) Need-for-Privacy (NFP) and 2) Need-for-Socializing (NFS) (Haans et al. 2007).

How much space and how much privacy is ideal depends on the type and nature of the work to be done (Lahtinen, Ruohomäkia, Haapakangas and Reijula, 2015). Acoustical and visual privacy is dependent on offices and their degree of variability. Offices like cell-offices are known to provide most acoustic and visual privacy, whereas open-plan based offices have varied means to achieve privacy. Visual privacy is easier to accomplish in contrast to acoustic privacy that is more complicated. Partitions and the amount of distance to colleagues are physical features perceived by a person in order to determine privacy and crowding (Newsham et al. 2009). Employees' satisfaction with the job and workplace corresponds with privacy. It is essential to mention that jobs that are "complicated" tend to find privacy more important than job satisfaction; alternatively, it is the reverse for routine-based jobs. Status can help explain this claim (Ruohomäki, Lahtinen and Reijulaab, 2015)

Steele (1973, cited in Haans et al. 2007) suggests that status and importance in organisations are strongly connected to privacy, where it is displayed in offices where the least accessible employees are at the highest ranks and seldom hold private offices. With reference to this, it is difficult to recognize if privacy or even status being expressed helps influence job satisfaction. Kupritz (2000) claims that in organisations, privacy can significantly impact the training intervention's level of success of failure, amongst other aspects included. The interaction and communication amongst employees and key features in office designs are majorly linked to the idea of privacy.

2.11.1 Stress

Any environment that makes a person experience discomfort or a sense of stress leads to environmental stress. According to a physiologist Selye (1840, cited in Daneilsson, 2010), defense and adaptation mechanism are two human reactions to stress. Sundstrom (1986, cited in Daneilsson, 2010) adapted Seyle's interpretation of stress into psychological stress reactions in an employee in an office setting as follows:

1) Arousal also referred to as physiological excitation or consciousness, and this can be a result of an intense stressor. So depending on how much arousal a stressor causes, it can manifest into different levels of behavioural changes.

2) Stress: is a reaction to a perceived threat, it is often difficult to measure it to distinguish from arousal. However, stress is often in response to the changes as a result of which we tend to expect negative repercussions.

3) Distraction and overload: distractions often take a person off track and as a result, the workload tends to build up. If the workload is built to the point that it is beyond the employee's ability to handle, then they have reached the point of overload.

4) Fatigue: as a consequence of the overload or the various stressors, the employees can be fatigued, which reduces their comfort and therefore compromises their performance.

An environmental stressor, also physical stimuli when identified by a person, it is taken as a coping strategy (e.g., Clausen and Wyon, 2008). The process in which that person handles the stresses they were inflicted on, is referred to as the "coping response" (Vischer, 2007). Coping responses include patterning and personalization.

2.11.2 Environmental Stressors

When a person acts to an environmental factor by displaying stress, only then it can be classified as an environmental stressor. A certain amount of loss of control by a person is essential to display features of any and all environmental stressors in general. Specifically, in office environments, crowding, noise disorientation, and environmental deprivation are environmental stressors. However, this section will discuss the stressors noise and crowding – being the most important environmental stressors.

Noise: In terms of work environment, noise can be defined as an undesirable sound that is uncomfortable and leads to stress. Vischer (2007)'s views of noise not being a threat to the health and well-being of an employee, despite that, noise can be a job-related stress, as it is a source of overload (Banbury and Berry, 2005). It is also the most vital factor in an office setting due to reasons such as a) highest common cause for complaints in offices with specificity to open plan layouts, and b) correlated with office employees' environmental dissatisfaction and job dissatisfaction (Newsham et al. 2009). However,

the negative effects that noise has on performance level plays a major reason that researchers are being particularly alert to comprehend. Alternatively, it is important to note that some sound around the office, for example from colleagues can help to stimulate, strengthen cohesion and allow people to not feel isolated at work, this making it a positive aspect (Haka et al. 2009).

The reactions to noise are very individualistic; the grade of annoyance towards noise depends on the purpose, possibility to foresee and to control it. The attitude towards the source of the noise, type of work assignment and personal character also seems to matter in terms of the grade of annoyance. It is to be noted that the most disturbing noise, that is considered to hold meaning and information, is not necessarily the loudest one. Conversations between colleagues and telephone ringing are noted to be more disturbing than office equipment and traffic noises (Ryherd and Wang, 2008). Another aspect to noise is also the distance of the person talking. According to a survey conducted by Christensson (2009), any conversation heard from a close distance is not as disturbing as the one that is as further as 8-10 m away from a person's workstation. A person often accepts and tolerates the noise more when one considers that that noise cannot be eliminated like traffic (Haapakangas et al. 2008). On the other hand, some noises like equipment are considered as a controllable stressor and are found to be positively influenced by perceived control. Therefore, reducing negative outcome and helps eliminate specifically high level of stress (Banbury and. Berry, 2005); the degree of controlling noise reduces the stress hormone adrenaline (Haka et al. 2009).Glass and Singer (1972, cited in Danielsson, 2010) show that the exact amount of exposed noise is not as bothersome to a person, as the ability to control of the prevention of that noise.

Noise level and the relative amount of complexity of simplicity of the task are the dependent aspects to noise interference, however contradicting the conclusions that were initially arrived in associating performance and noise. To reiterate, research by Sundstrom et al. (1994) failed at not being able to draw a link between noise disturbance and performance rating. Another study on controlled open plan offices conducted by Haka et al. (2009) displayed speech condition to be the lead factor playing in influencing performance where performance reduced significantly, when participants were exposed to irrelevant speech with the help of a Speech Transmission Index (level 0.65 STI) and measure through operation span task, serial recall, and activation of prior knowledge. Despite that the performance was not affected, the disturbance was more sensitive and

was subjectively perceived. Unpredicted noise also can lead to an opposing after effect according to other laboratory-conducted studies (Kaarlela-Tuomaala et al. 2009). Another aspect to noise is the frequency: where low frequency displayed to being negatively impactful on cognitive performance of a person, as it is understood to be very hard to get used to and difficult to ignore, hence tiring the person. It also increases the level of stress hormone cortisol in the saliva among people exposed to low-frequency noises (Bengtsson, 2003). The varied tolerance of noise affects people's performance, where the threshold reduces when working on an assignment and significant at the level of 35 dB, as noted by Franzén (1969, cited in Jensen et al. 2005).

However, a term known as positive distraction of attention, as suggested by Sundstrom (1986), occurs when constant noise during brief work sessions can lead to improved work performance. The hypotheses predicts that noise level, such as reading comprehension, stimulates extrovert personalities in comparison to other that find it disadvantageous (Standing, Lynn, and Moxness, 1990). Age and gender do not impact but contradicts the level of disturbance. Age of a person also altered the degree of disturbance towards noise according to a study conducted by Byström (1999).

2.12 Different Design Aspects Affecting Employee Productivity

It has been found that workplace design and management if ideal and comfortable to the employees, it improves their satisfaction levels and therefore also their productivity (Newsham et al. 2009; Daniellesson and Bodin, 2008; Huang et al. 2004). Therefore, over time, companies have started paying more attention to design detail in order to attract employees and retain the one's they have as well as increase the productivity levels (Hameed and Amjad, 2009).

Over 200 business managers were participants in a study conducted by Gensler (2005) showed that improving workplace design improved employee output by over 19% and management productivity by 17%. If these were proven further, they would have many applications in the real world. A similar study conducted by them in the USA concluded with them finding that 90% of the surveyed people thought that a better work environment would mean more productivity.

So, in today's competitive market, in order to attract more skilled employees, companies will have to up their architecture game and invest more in the betterment of their design. Brill et al. (1984, cited in Hameed and Amjad, 2009) ranked factors in order of least to most impact on productivity, these are furniture, noise, flexibility, comfort, communication, lighting, temperature and finally air quality. 15-20% improvement in productivity was seen when ergonomic furniture was used. People prefer less noise and think that noise can make the workplace less effective. According to the Data management association statistics, there is a 40% decrease in productivity and 27% increase in errors when there is a lack of acoustic privacy, especially in open offices (McLaughlin, 2000, cited in El-Zeiny, 2012). In a recently conducted study, it was found that the general, day-to-day productivity of the workplace was affected by the lighting. The Commission for Architecture and the Built Environment and the British Council for Offices found that proper light and enough natural sources of it can reduce absences and increase productivity.

There is notable effect seen between the temperature and humidity and degree of fatigue felt by an individual. The WHO recommends that the maximum temperature in a workplace be no more than 24 degree Centigrade, however, there are no regulations as such about the temperature in most workplaces (Montgomery, 2004). When asked what the employees thought could be improved in their workplace, they claimed that access was the main thing that the preferred. They liked to be in close proximity to the necessary things like copiers, the restrooms, and other important office equipment that would help their comfort levels and help them work more efficiently (ASID, 2002, cited in El-Zeiny, 2012).

To what degree the natural scenery view at the workplace benefits the well-being of the office employees is yet to be determined by the studies being conducted. Along this line a researcher from Texas AandM University, Roger Ulrich (2002) attempted to understand the effect of flowers and plants productivity at the workplace. He found that when they introduced plants into the workplace, the productivity of all employees, men and women alike was improved, and so was their creativity. Furthermore, even the colour of the room or walls in a space can impact the people in it. It is said that cooler colours are less distracting and therefore ideal to workplaces compared to the brighter one's that tend to be arousing and therefore distracting (Inform Design 2009).

Indoor environment quality is based on several unquantifiable and unrelated factors such as air quality, design, temperature, etc. making it hard to assess the indoor environment quality (Salonen et al. 2013a; 2013b). Although difficult to accomplish, the best approach is to perhaps estimate the combinatorial effect all of these contributing factors may have. Therefore, several researchers are beginning to focus on this issue and the impact of the indoor environmental factors on output at workplaces. Seppänen, et al. (2004, cited in Seppänen, et al. 2006) proposed a simple temperature-productivity relationship based on previous field studies. Kosonen and Tan (2004) analysed the experimental work by Wyon et al. (1975, cited in Kosonen and Tan, 2004), Wyon (1996, cited in Kosonen and Tan, 2004), and established quantitative relationships between PMV and performance of two typical office work tasks: thinking and typing. Tham (2004) observed in his experiment that call-centre operators' performance, measured by average talk time, increases from 187s to 216s when the temperature is decreased from 24.5°C to 22.5°C. Seppanen and Fisk (2006) analysed 148 assessments of performance from 26 studies, and proposed relative performance vs. temperature curves. Wargocki et al. (2002) performed three independent laboratory experiments to investigate the effects of air quality on human health, comfort and occupant productivity in offices. Based on this data, Wargocki (2008, cited in Haynes, 2008) derived an empirical linear relationship showing that a for every 10% drop in the number of dissatisfied employees there is about a 1.1% increase in performance, this is assuming the dissatisfied employees comprise between 25% to 70%. 5% to 10% increase in productivity was found when air quality was improved, which agreed with Wargocki (2008, cited in Jin, 2013). In addition, Seppanen and Fisk (2006) made use of experimental data from 7 independent previous studies and established quantitative relationships between performance and ventilation rate. The most important drawback to all these studies is that they all look at this one factor at a time as opposed to their combined impact, which is often a different scenario. Therefore the results can only hold true if the simulations were, in fact, the same as the real life office scenarios, which is usually not the case and therefore leads to a misjudgment.

Only a small fraction of the studies being conducted in the last few years have considered a combinatorial approach toward all factors while studying how the indoor environment affects people. Clausen et al. (1993) seem to be among the first to attempt to quantify the relationship between air quality, temperature, noise, and how these affect the comfort of the employees. They did not, however, include light as a factor. Yet another researcher, Kawamura et al. (2007, cited in Jin, 2013) came up with a way of quantifying satisfaction

with relation to the productivity, however, failed to regard other quality aspects of the environment.

Fisk (2000, cited in Fisk et al. 2011), using various office and residential buildings in the context of previously conducted research, statistics, and studies attempted to study the health benefits of improving the IEQ in both settings. He found that in 1996 alone, improving the IEQ estimated an improvement of about $20-120 billion in the USA. There is a complex association among the IEQ factors that has a direct or indirect effect on productivity and economics in a workplace (Stanton et al. 2004; Hameed and Amjad, 2009). This is represented in the figure below:

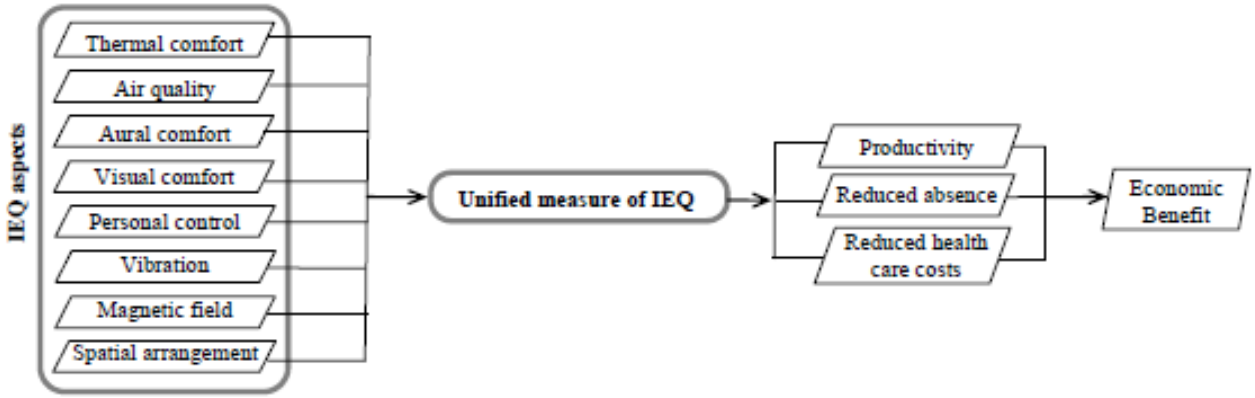


Figure 7: Association between IEQ factors and economic benefits of this to a company. Source: (Jin, 2013).

Since design studies are often conducted post-occupancy, it is not possible to ask people questions and therefore they need to use simulation studies to obtain their results. Clements-Croome and Li (2000), Hameed and Amjad (2009), and Chiang et al. (1999) resorted to this approach when they conducted a survey in offices in Readings, UK in which they established a quantitative relationship between unsatisfactory IEQ, job satisfaction, crowded working space, and self-assessed productivity. In a similar study by Hameed and Amjad (2009) they proposed a regression equation after they surveyed 13 banks in Pakistan to associate the satisfaction and productivity to other indoor environmental factors. Chiang et al. (1999) formulated an indoor environment index (IEI) using the hierarchy prevalent in the workplace to form their questionnaire. IEI was based on the combined outcomes based on noise, light, temperature, indoor air quality, and

electromagnetic field. Even though all of the abovementioned studies provide valuable insight, in terms of data collection, these all fall into qualitative measures and are therefore irrelevant in the design.

There are ten basic design elements can positively impact the workplace environment and promote the work being done (Stringer, 2013):

1. Thermal Comfort and Temperature
2. Access to Nature, Views, and Daylight (lighting)
3. Sensory Change and Variability
4. Colour
5. Noise Control
6. Crowding
7. Human Factors and Ergonomics
8. Indoor Air Quality
9. Choice
10. Employee Engagement

2.12.1 Air Quality

Lee et al. (2012) found that air quality is a major player in determining productivity and irritability in the workplace. The researchers at BOSTI (1981, cited in Haynes, 2008) found that similar to temperature, if there is a drop in air quality, there is a consequent decrease in productivity. However, this only accounts for 3-4%, and so far no data has found a bigger difference. Good air quality is a combination of ventilation, ideal temperature as well a lack of pollution. Arguably, pollution isn't that much of a problem at offices, however, the main problem lies in inadequate ventilation provision which should be based on the seasons, humidity and other geographical factors (e.g., Seppänen et al. 2006). Furthermore, there seem to be more complaints from mechanically

ventilated buildings, as opposed to the natural ventilated one's (Lin, Lau and Yuill, 2014).

It is essential to ensure that the indoor environment is of an appropriate quality as the employees spend a lot of time in there (Dorgan and Dorgan, 2005). They hypothesize that productivity of the occupants is linked to the environment and the health of the occupants both and therefore they attempted to establish the environmental components. "*The indoor environmental quality (IEQ) is composed of factors such as space, temperature, humidity, noise, lighting, interior design and layout, building envelope, and structural systems. A subset of the IEQ is indoor air quality (IAQ). The factors that define IAQ are temperature, humidity, room air motion and contaminants*" (Dorgan and Dorgan, 2005: 113).

Dorgan and Dorgan (2005) insist that the indoor air quality (IAQ) is greatly responsible for the health and productivity of the employees. Their proposal is based on three studies, one of which was funded by the National Contractors' Association, which investigated the benefits of improved air quality IAQ and how it reduces health costs and increased productivity. The study was originally conducted in 1993 and developed further until 1995. The other study was limited to the hospital industry in which the focus was to review around over 500 papers attempting to understand the relationship between air quality and productivity. Dorgan and Dorgan (2005) found that "majority of the research studies indicate an average productivity loss of 10 percent due to poor IAQ. Therefore, by improving the IAQ, a conservative benefit of 6 percent could readily be achieved" (Dorgan and Dorgan, 2005: 128). They added that even though these studies are being conducted in a school and workplace context, their greater application is seen in hospital settings. Furthermore, there are other factors currently being ignored that need to be included such as crowding people in smaller spaces, population density, cooking etc.

Wargocki et al (2000a) implemented a traditional experimental approach to each of the three experimental studies with 9- subjects to quantify the effect of IAQ on productivity. They measured the air quality by interventions, and its effect on the employees was assessed through an air quality acceptability scale. The methods used were measurable and were not questionnaire based or self reported, but measureable my making them performs tasks such as texting, typing proofreading etc. Wargocki et al (2000a) concluded through this that there is a link between good air quality and productivity in the workplace. "It confirms that good air quality improves the performance of text

typing, and a similar tendency is seen for addition and proof-reading. A positive correlation between the air quality, as it is perceived by occupants, and the performance of typing, addition, and proofreading" (Wargocki et al, 2000a: 635). The limitation to the results obtained through these tasks is that the activities being evaluated are repetitive activities like typing, proofreading, etc. Wyon and Wargocki (2005) evaluated experiments conducted in call centres as two field experiments. the research involved a call centre in Denmark (temperate climate) and one in Singapore (tropical climate) (Tham et al, 2003). For both studies, a 2X2 design was used wherein they were to perform the same repetitive task for 8 weeks with each condition being maintained for a week at a time. The index of productivity was measured based on the talk time, where increased talk time was an indication of increased productivity. This led to the revelation that indoor air quality had an even bigger impact on productivity than they were led to believe through previous experiments.

It is necessary to encourage developing research in the fields since that is when research gets done in its true context. However, unlike the call centre workers, most offices do not have a clear-cut measure of productivity. Some offices involve exchanging of ideas and knowledge and sometimes even greater mobility within the workplace. Therefore providing IAQ in all contexts is challenging.

Because human beings produce heat and a combination of other variables like clothing, activities taking place at work, etc. it is a challenge to establish the right thermal system in any given space (Dwyer, 2006).Dwyer (2006) endorses Ole Fanger's work relating to predicted mean vote (PMV) and percentage population dissatisfied (PPD), as being the key to the development of standards such as ISO 7730 and the ASHRAE Standard 55. They can predict the number of employees dissatisfied with the thermal system using the PMV. If 80% are satisfied with the thermal system, only then is it considered to be a success (Dwyer, 2006). The remainder of the 20% falls into an area that evidentially requires further research.

2.12.2 Lighting

Up until the widespread appropriation of power in the 1940s, sunlight was the most widely recognized wellspring of lighting in working environments and houses. This was

supplanted by counterfeit lighting, yet lately, there has been an ascent in enthusiasm for utilising natural lighting. Consequently, present-day structures are built to offer lots of natural daylight alongside crisp air and other natural qualities. Current studies reveal that natural lighting offers mental and physiological advantages to the occupants (Edwards and Torcellini, 2002).

Improving lighting in the office is one of the most cost effective and easier ways of improving productivity since the employees often claim that lighting is an important aspect of their office environment, especially daylight access (Abdou, 1997). Heschhong et al. (2002) use a study conducted on school children performance in relation to daylight and reworked it in the context of the office environment. The study established a statistical correlation between daylight and better student performance. They assessed daylight using a 5-point scale measure, 0 being absence and 5 being high amounts. And the assessment used students in grades 2-5 and among those only with experiences standardized test takers were chosen. Their results, like in the office study, showed improvement in the grades of students with better lighting. “If day lighting enhances the performance of children in schools, it is not too large a stretch to suppose that it might also enhance the performance of adults in office buildings or other workplace settings” (Heschongand Wight, 2002: 8.91).

Light tends to influence our perception of the environment and consequently the architecture. Daylight can impact perceived stress and anxiety (Walch et al., 2005 and Lehrner, Eckersberg, Walla, Pötsch, and Deckee, 2000). It is proven that people who are less exposed to natural light tend to be depressed and tired (Rosenthal in Evans, 2003). Similarly, windowless offices, therefore, increase tension and stress while those with access to natural light tend to be more alert. This has to do with the hormone levels in response to light which also tends to impact one’s interaction with others in addition to concentration (Küller and Lindsten, 1992). Light is responsible for controlling stress hormone’s and melatonin as well as the sleep cycle, which explains the findings mentioned previously (Ejhed and Liljefors, 1990). In contrast, there is also such thing as too much light, since it can cause distraction by causing glare in the eyes leading to strain and headaches (Veitch, 2001; Vischer, 1996). The impact of light on people can therefore be considered complicated since too much or too little can cause different effects, for instance, when speaking of windowless rooms, the lack of light can only impact someone

based on how much time they actually tend to spend in that space, along with how the space is organised (McCoy, 2002).

Where a window is located is critical, as windows admit daylight as well as a view of the exterior. The view affects the well-being and satisfaction of workers. Furthermore, the health aspects of view have been stressed on in many studies(Hartig, Evans, Jamner, Davis, and Gärling, 2003).

It is found that windows along workstations make employees more satisfied with their environment (Sundstrom, 1986). Besides the benefits of natural light, it also helps to process information more efficiently with respect to time of the day, weather, seasons, etc. furthermore, Sundstrom recognizes that the positive aspects of windows may stem from the idea that they are sort of a status symbol and in being so, they tend to have a positive perception of one's environment. Even though natural seems to be the preferred option, some employees decorate their interiors with a nature theme when having windows are not an option (Heerwagen, 1990; Heerwagen and Orians, 1986).

People almost always tend toward natural rather than artificial lighting in their workplace, and seeing that is the case, people tend to prefer having access to a window and are often found to be more satisfied (Vietch, 2005). This is probably because natural surroundings are often a great source of variation and sensory stimuli. It, therefore, becomes important to establish a sense of biophilia – the natural bond between human and nature, in the workplace. Furthermore, people also need to spend some time outdoors in the day (Stringer, 2013).

Heerwagen (1998) also agrees that daylight and windows in combination with constant active and passive interactions with nature, sensory change, and variability are good for the well-being. Augustin (2009) makes an augment for the role light plays in regulating the sleep-wake cycle also known as the circadian rhythm as stress is often a result of a disturbance in the natural cycles in our body. Kellert, Heerwagen, and Mador (2008) reach the conclusion that people, if given the choice, like higher terrain, with field and shrubs around.

The lack of studies focusing on illumination can be credited to the Hawthorne experiments (Roethlisberger and Dickson, 1939) since their results established that the work output of the employees increases regardless of increasing or decreasing lighting levels. Therefore, they seem to plant the idea that physical environment played no role in

improving working productivity (Roethlisberger and Dickson, 1939). Veitch (2005) therefore argues an economical outcome approach rather than an assessment based on satisfaction of the employees.

Boyce et al. (2003) drew a comparison between 'best practice lighting' and 'base case' lighting which was to represent the modern workplace condition at workplaces in their field simulation study to find out how the light effects work. They conducted it over one business day and the employees work performance was measured and they were also asked to self-report their comfort and perception of health and well-being. This only led to the conclusion that light affected everyone differently and therefore, maintaining one type of light condition throughout would not help productivity at all.

"Individual lighting controls can address the problem of individual differences in lighting preferences. When one does not know which conditions will create the positive effect, individual controls allow people to self-select their preferred conditions" (Veitch, 2005: 213).

Whitely et al. (1996) proposed that one's "locus of control" explained their need control their surroundings. Locus of control was also among the killer variables that was proposed by Leaman and Bordass, 2000, Boyce et al (2003) conclude that: "People with dimming control report higher ratings of lighting quality, overall environmental satisfaction, and self-reported productivity" (Boyce et al, 2003: 4).

The credibility of the results obtained by Boyce et al (2003) lay in the fact that the study was conducted using real workers performing their actual tasks in a real workplace. There are a few limitation to this study, however, 1) the research is restricted to only two field simulations; 2) while there were real office workers assigned real task, the office environment was not their regular one, but a simulation controlled environment which is important to consider while analysing the obtained data and finally 3) the results may be more reliable if the experiment lasted longer than one day, or over a longer period of time.

Veitch (2005) recognised the need to form a lighting quantity model in the context of economic and architecture as it is quite difficult to associate lighting directly to productivity as causality. The model would also have to account for how lighting affects behaviour, communication, mood and mental state. This can open a possible path for future research on the subject (Haynes, 2007c).

2.12.3 Layout

There are two known workplace designs, namely, the open arrangement as well as the cellular office, and their comparison has been much debate lately. The problem with this is that, while people refer to these two office arrangements often used in research and dates, the reliability of the data is uncertain, as there is no set-in-stone, universal definition of these terms.

Open plan concepts have become quite popular in recent times. Open plan designs help in reducing costs and in promoting collaboration and productivity among staff members. But open plan designs have their own drawbacks as well. For example, open plan designs increase the cognitive workload of employees while also increasing cognitive stress among employees (de Croon et al. 2005). Several other researchers have listed several other drawbacks of open plan designs. For example, Pejtersen et al. (2006) found evidence of the rise in prevalence of other problems while Pejtersen et al. (2011) found that it may lead to increased sickness related absenteeism. Haapakangas et al. (2008) found noise related disturbance as one of the problems associated with open plan designs while Banbury and Berry (2005) found that open plan designs increase distraction and lead to lack of focus on work. Kaarlela-Tuomaala et al. (2009) found that open plan designs lead to lower self-estimated work performance. These studies suggest that while open plan designs may be useful to certain extent they also have their own drawbacks.

The debate tries to focus on the issue of which is the better design, the open plan vs. the cellular office and at the same time incorporating the workplace processes and activities into the design of the environment (Stallworth and Ward, 1996; Laing et al, 1998; Mawson, 2002). Gensler (2005), an engineering firm, states the monetary impact of improper planning of the workplace would result in: "*Poorly designed offices could be costing British business up to £135 billion every year.*" (Genlser, 2005)

The themes identified by Gensler (2005) along with their highlights are summarised below:

Theme	
The productivity leap	A 19% increase in productivity is expected with better environment
Workplace matters	Over 79% or 4 out of 5 employees claim their job satisfaction is affected by their environment at work
Brand control	50% employees who think that their companies brand can be represented by its design while 50% disagree or are unsure
Work styles / workspaces	30% think personal care, 24% think climate control, while 21% think temperature is the key to an ideal workplace environment
The creative office	Over 38% find it difficult to be creative at work
The "Thinking Time" directive	78% of them think they have less time to think and more pressure on them than they had 5 years ago

Table 4: Workplace layout dimensions. Source: (Gensler, 2005)

In so doing Gensler (2005) successfully establishes a relationship between productivity, the workplace, human resources and business methods. "The working environment has a fundamental impact on recruitment, retention, productivity and ultimately on the organisation's ability to achieve it business strategy" (Gensler, 2005).

Gensler (2005) studied 200 middle and senior position holders in different fields like law, media, and finance. Even though this was not a large sample size, it is notable the data obtained on the productivity was not a measure of the estimate but in fact obtained from analysis done by experts.

Ilozor and Oluwoye(1999) focused their interest on the research on the open office plan. They surveyed 102 open plan offices in Australia that was targeted at the office

administration in charge of the design. Ilozor and Oluwoye (1999) used a model that attempts to associate the following factors:

- Open-plan Measures
- Management Control, and
- Effectiveness of Facilities Space Management

To assess productivity, Ilozor and Oluwoye (1999, p239) he asked a yes or no question in addition to his survey sectioned: "Practice of measuring staff productivity." Ilozor and Oluwoye (1999: 244) finished up their examination by expressing that: "A greater perceived support on informal meetings by open-plan workspace is associated with increased measuring of staff productivity."

This study like many other was in support of the better working environment, however, there is potential for generalization of the outcomes. Firstly any conclusions drawn from the research must be limitedly compared only to other similar workspaces in Sydney, Australia. Secondly, it is important to distinguish that the question regarding the efficiency focuses on the productivity of the employees, not the profitability of the company. And finally, keep in mind the fact that the people being questioned were administrative in their position in the company and not the employees themselves.

Ilozor et al (2002) investigate the how utilization of creative work settings could enhanced authoritative execution and to accomplish this they used 102 work settings, with a few working null hypotheses on inventive work settings and authoritative execution that were in practiced. They used the Kruskal-Wallis H-test to assess this. In contrast to the studies that were conducted earlier, (Ilozor and Oluwoye, 1999), Ilozor et al (2002) they used a range of value to assess productivity.

One of the inferences made by Ilozor et al (2002) was that: "The more a work setting is perceived to be innovative in terms of fostering staff interaction, the greater the measuring of staff productivity and the level of productivity" (Ilozor et al, 2002). This calls for use of creatively designed surroundings as a means of promoting more communication between colleagues in the office. It gives off the impression that they need to create a situation wherein people are obligated to speak to one another. Ilozor et al (2002) also assumed that hierarchy can be established through the physical design of the workplace. While the ideas he proposes seem to be forward and more developed than

the previous research, fact remains that the data was obtained from management and not the employees themselves.

Allen et al (2004) discuss how changing the workplace design can establish hierarchy. The referred to several Government investigations in the UK and found that arrangement of office space can establish hierarchy just as well as it can foster communication and openness among employees.

Bradley and Hood (2003) introduced the thinking that the organisation must be able to cope with the changing business world i.e. 'workspace adaptability' (Becker, 2002). They said the adaptability was a sensible way to deal with the office plan. Firstly, the recognized the importance of maintaining being organized, that way, if the market were to change, the company would adapt easily. Bradley and Hood (2003) proposed four golden rules to ensure that business was at par with the fast pace of the corporate world:

1. "Systematically and regularly cleanse "stuff" to enable portability
2. Design for "busyness" to keep a 'buzz'
3. Reduce bespoke settled fit-out parts and embrace re-locatable segments
4. Systematically assess the usage of space and innovation along with moving work home's."

While these look like simple housekeeping techniques, the last rule focuses on the need to alter the work environment with the demands of the time and the change in procedures to decrease any conflict that may occur as a result of the change (Mawson, 2002).

2.12.3.1 Aligning Office Layout and Work Processes

In the past, writers, for example, Stallworth and Kleiner (1996: 36) have discussed "Person-environment fit," and Mawson (2002: 1) asserted that profitability misfortunes could be credited to an incongruity between the workplace and the work attempted in that environment. "Contrast this with the approach taken to designing a manufacturing plant where detailed consideration would be given to the processes to be performed within the building, before then designing back from these to get the best fit."

Studies commenced by DEGW and Building Research Establishment (BRE) endeavoured to tackle the problem of coordinating the work procedure and the workplace environment (Laing et al, 1998). The exploration inquiry assumed was: "Most office buildings and their environmental systems were designed for typical 9 to 5 activities, but how will they perform when that pattern of use changes?" (Laing et al, 1998: 1).

The exploration embraced tried to tackle the issue of authoritative work configurations and the workplace. Three components (affinities) were explored in more prominent point of interest:

- Work Patterns
- Building Types
- HVAC Systems

The outcomes incorporated an evaluation of the three segments (affinities) to distinguish the ideal relationship of the workplace for the work designs. To aid in comprehension of the different work designs, four innovative illustrations were created by Laing et al (1998, pp. 21-24). They were as follows:

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

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

In pursuit of the perfect match between the environment and procedure, Laing et al. (1998) used work examples to come up with four potential settings. They first designed a basic model to describe office-based work. The model was based on autonomy and independence of choice to work when, where and how and secondly the amount of eye-to-eye interaction in the workplace. The drawback was the size of the study; they only used 8 contextual studies. Moreover, while they focused on the workplace and the procedures, they never addressed the productivity.

Haines (2005) came across the classes proposed by Laing et al. (1998) in trying to measure productivity, in the context of office arrangement. He then used ANOVA tests to gather information on the four work designs proposed by grouping the employees into one of the distinct designs to assess their productivity (Haynes, 2005). Mostly, the every one of the designs has a negative impact on productivity (Haynes, 2005). This conclusion itself states that the consequence of this would be a conflict between workplace and the work to be conducted (Mawson, 2002; Peterson and Beard, 2004). To resolve this, occupants could be counselled at all phases of the design process to ensure that the office design is adequate in terms of occupant's satisfaction (Burke and Chidambaram, 1999; Laframboise et al, 2003).

2.12.3.2 Open-plan Versus Cellular Offices

BOSTI associates, driven by Michael Brill, conducted two studies to understand the impact of workplace design on worker output. The first study was in the 1980's; 1000 specialists from over a 100 organisations participated in this study. The made two volumes of publications that contained the data analysis of this study, namely: "Utilising Office Design to Increase Productivity" (Brill et al, 1985). The second study was conducted in the 90's to 2000 and consisted of 13,000 cases (Brill et al, 2001). The second study led to different conclusions from before. The work environment changes were driven by four major factors (Brill et al, 2001, p 5):

- “Organisational structure and procedures”
- “Workforce states of mind and desires”
- “Technology and its steadily expanding force and extensive arrangement”
- “New acknowledgements about, and procedures for, the work environment.”

In the second study, they assessed individual execution, group execution and satisfaction with the workplace. The study also gathered information on the single occupancy, double occupancy, and open arrangement office layouts. Brill et al (2001, p 17), then came up with three definitions:

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

Workspace: Space where an employee sits (mostly) when in the office Private (Cellular) Office: A workspace that has four walls to the ceiling and a door

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

Brill et al (2001, p19) ranked the 10 most important factors:

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

The two most important factors are associated with specific tasks. Workers need to be able to carry out work without distraction but at the same time be able to interact with their colleagues when need be. According to the findings of Haynes' (2007b) study, distraction has the biggest impact on the perception of productivity while interaction has the most positive impact. There is evidently a conflict that exists in the workplace to balance out the interaction vs. distractions.

According to the findings of Brill et al (2001), the more the number of occupants in a room the more they report the distractions and conversations. Becker (2004) like Brill et al (2001), was concerned with the open-plan design, especially with the cubicles: "*Research by Michael Brill and his associates as well as our own studies show that despite all the furniture, technical and social fixes that been tried to render cubicles more acceptable to employees, on the whole cubicles flunk*" (Becker, 2004: 25).

From the analysis of their data, BOSTI Associates concluded that "*The really groovy, wide-open office, with folks shown interacting informally all day, is a visually seductive myth. Research shows it doesn't support work very well and, in fact, can incur significant losses in individual and team performance and job satisfaction*" (Brill et al 2000: 36).

Brennan et al (2002) assessed the findings from a study, which looked at the effect transitioning from a closed cellular office plan to an open space one. They gathered data between four weeks before and after the move they went on for six months. They handed out over 80 questionnaires at each of the three interim points but only received 21 responses. Therefore the obvious drawback of this study was the small sample size. Satisfaction was measured on the basis of the physical environment, physical anxiety, relations with colleagues, and supposed execution. The execution measure was self-evaluated but it was credible because they used a 20-item scale." *Perceived performance was assessed through a 20-item subscale consisting of items such as 'I am able to stay focused and 'on task' at work' and "I am able to complete my planned tasks for the day"* (Brennan, Chughand Kline, 2002: 289).

The conclusion from the study was that for the six-month period after the shift, the subjects were not happy with the move, and continued to be unhappy for a while. They found the open arrangement to be distracting and therefore not conducive to working as efficiently Brennan et al (2002). A limitation, however, was that they didn't divide the subjects into subgroups and in that, they failed to look at how each of the work processes

may be affected differently. Furthermore, there was no control group to compare the outcomes with. This would have allows for a whole other line of possibilities, for instance investigating whether the move was the reason for their disappointment or whether there was another possibility.

Becker (2002) claimed that in addition to being a tool to attract and maintain new employees, workplace design could also represent the companies brand personality. How they chose to design the workspace can also give them room to be more adaptable in the case of change while utilising the office space to its full potential. Open plan arrangements allow for a 'hoteling' approach with less need for modifications. The 'zero-time' theory states that even though the space itself doesn't change over time, the approach to the work areas does. It was eventually found that no organisation really welcomed the idea of hoteling practices, even though Becker thought of this as the ideal work situation that would allow of adaptability.

2.12.3.3 Aligning Office Layout and Human Behaviour

The popularity of open plans has certainly come from their cost-effectiveness when making adjustments (Marquardt et al, 2002; Veitch et al, 2002; Haynes, 2007c). Veitch et al (2002) in response to the problems, managers have come up with open spaces designs with smaller spaces. At the risk of creating an uncomfortable and congested office space, they were more interested in saving the associated cost by creating these smaller spaces. Veitch et al (2002) they argued that these consequences can be a direct response to the physical condition or can result in the generation of stress or anxiety from mental discomfort.

They questioned 419 employees of three different administrations to gather data about the open-plan environment and their opinions on it. The estimations were made considering several physical aspects like temperature, noise, lighting, ventilation, and workstation and occupiers finished a 27-item poll. The poll comprised of 18 inquiries identifying with fulfilment with the environment, two inquiries identifying with general fulfilment with the environment, and two inquiries identifying with occupation fulfilment.

Satisfaction	Items
Satisfaction with Privacy	Visual and auditory privacy, audibility of other's conversations, other background noise; other distractions, workstation size, crowdedness, control over conditions; the distance between co-workers; and aesthetic appearance.
Satisfaction with Lighting	Lighting quality, the amount of light on the desk, the amount of light for computer work, computer glare, and access to a view.
Satisfaction with Ventilation	air quality, temperature, and air movement.

Table 5: Satisfaction with the environment: A three - factor model. Source (Veitch et al. 2002)

Vietch et al. (2002) came up with a three-element model to attest to the benefit of the open-arrangement office situation as shown in Table 3. While the light and ventilation are a part of the physical environment, the aspect of privacy brings up a new line of research into the behavioural aspect of the workplace (Haynes, 2007d).

While the open plan does allow more communication and therefore collaboration among employees (Van der Voordt, 2004), the other side to this is the feeling of swarming and loss of security. "Open-plan and shared offices have most complaints about lack of privacy people have difficulty concentrating, dealing with personal matters and colleagues' annoying habits" (Nathan and Doyle, 2002: 26).

Nathan and Doyle (2002) acknowledged that while lessening the space would save money, there are other consequences, both good and bad towards the occupier's productivity. This entirely depends on what task they are supposed to carry out.

The goal is to reduce crowding, when people feel crowded, they tend to be more stressed and this translates to job dissatisfaction. The concept of space varies among cultures, and other preferences, not all people feel the same amount of crowding in the same space. Sally Augustin, an environmental psychologist suggests a few rules of thumb about people and spaces:

It is possible to lessen the feeling of crowding with mirrored walls, higher ceilings, brighter and lighter colours. Men are more likely to feel crowded than women in the same situation as they tend to have better peripheral vision and therefore a different perception of space. Additionally, people working in high rise buildings tend to feel more crowded, this is however not the case as you go to higher floors as the daylight and view make up for it. Other things that help reduce the congestion feeling is furniture, plants, pillars and other aesthetic elements (Stringer, 2013).

"High-density environments- or environments that people feel are crowded – seem to make complex tasks harder to do. But simple tasks become easier to do." (Nathan and Doyle, 2002: 26). Van der Voordt (2004) explained that there are more stimuli that are present in an open-plan environment when compared to the cellular ones. And this upsurge of stimuli could result in a variety of responses from the occupiers as some people may like to stimuli while other can develop anxiety as a result of the commotion (Van der Voordt, 2004).

Even though it is proven that in order to make a superior working environment, their needs to be some amount of prerequisites that come into play. The process of doing so is complicated due to the incongruent nature of all the variables to be considered. However, this could impact the well-being as well as the productivity of the workers.

"Poorly designed or managed workplaces damage staff physical and mental well-being" (Nathan and Doyle, 2002: 2). Vander Voordt (2004) compared two Dutch contextual studied that attempted to study the impact of the environment on productivity. He recognised that using perception as a measure was a major shortcoming for these studies as their analysis required a lot of assumption and only reached a probable conclusion. The two studies came up with two contrasting conclusions. Van der Voordt (2004) justified this as a result of the difference in how they were introduced to the process. Despite the discrepancies in the research, it was evident that the positive response was seen in the open plan office while the negative in the cellular ones. This stressed the necessity of a changed administration process into a migration venture (Laframboise et al, 2003).

Free choice of appropriate workplace	Organising the work takes up most of the time
Culture change: work more consciously	Installations waste time (logging on, adjusting furniture, tidying up)
Stimulus to work in a more organised way	Lots of acclimation (different workplace; varying colleagues next to you)
Need to finish them as there is no space to store them	Time spent in searching and noting information

Table 6: Productivity effects on work processes. Source: (Van der Voordt, 2004)

In addition to the results of the contextual investigations, Van der Voordt (2004) conducted a workshop exercise with specialists and exhibited an outline of the positive and negative impacts on work procedures of different work environments.

Van der Voordt (2004) tried to figure out two significant issues that were associated with office format. Firstly, it was thought that more shared environments resulted in less interest in work.This was reintroducing the idea that Becker (1990) presented about the non-territory offices. Secondly, he tried to tackle the good old open-plan versus cellular workplaces debate where Van der Voordt (2004) pointed out the annoyances in every environment. He stressed the importance for the creation of a space that allows the exchange of ideas while acknowledging the need for focus when working independently. He suggested the use of combi-office, to deal with the issue of work procedure request and workplace environment, Van der Voordt (2004).

“One of the main reasons for using combi-offices, with a mix of shared and activity-related workplaces, has been to overcome the disadvantages of office units (too closed, poor conditions for social interaction) and open-plan offices (too open, too many distractions)” (Van der Voordt, 2004: 145). The combi-office methodology seems to tackle the apprehensions of jumbling the workplace format and the work forms; it even offers a potential answer for the behavioural disputes. Be that as it may, building up the right adjust of private and shared zone’s obliges a definite assessment of client needs. When space is made, there will be another request to continually assess and deal with the workspace. This emphasises a requirement for dynamic work environment administration

to guarantee that the workplace environment continually stays steady of hierarchical and individual requirements.

Briefly, the workplace format writing has two key subjects:

- Literature addressing the open-plan versus cellular office debate; and
- Literature matching the workplace format to the work patterns of its tenants.

While cost-effectiveness makes for a good argument to support the open-plan in the open plan vs. cellular office debate, there is always the question of workspace design to support the various working styles and this supports the human commitment debate (CABE, 2005; Haynes, 2007c). It is important however to consider, how these environments are being used. Looking at the situation from the point of view of the actual occupiers in the office allows for an insight into the behavioural environment (Haynes, 2007d). So we are now left with the idea that in order to create the best workplace, it is important to consider the physical, environmental as well as the behavioural aspects and create a space which caters to all working styles.

There is an unmistakable requirement for binding together office productivity (Haynes, 2007a). The absence of an all-around acknowledged estimation of efficiency implies that like for like correlations of exploration ventures are constrained. It is recommended that without quantifiable efficiency estimation, a self-surveyed measure is a legitimate thought (Haynes, 2008)

To expand the straightforwardness for examination discoveries, there is a requirement for office productivity analysts to be unequivocal concerning their meanings of the workplace environment. In a perfect world, all-around acknowledged meanings of a private office assembled office, and open-plan workplaces would help with this complication. It ought to likewise be acknowledged that the definitions should not be confined to the number of individuals working in the environment, but additionally incorporate their level of office denseness.

To efficiently reorganise the office it is important to consider the roles and work that each of the occupiers plays. Laining et al. (1998) proposed a self-rule vs. connection model, which can help the differences in the various work examples. This also makes for a possibility of further subdividing these work examples, therefore, creating a scope for

more extensive research. Similarly, they can take into account the role and identity of every worker and incorporate these into the classification process (Haynes, 2007b).

2.12.4 Colour

Schauss (1979) conducted a study that is known as the pink prison experiment to test how colour can create a beneficial impact on a person's mind. Conducted on detainees in Seattle, Washington, the study had the detainees kept in bright pink jail cells. Results concluded to display forceful attributes and were applied to various detainment facilities in the United States and in Canada, painting cells in the same shade of bright pink. However, in the repetition of the results post, two-three years by the York University of Toronto displayed that the claimed results first seen as sedating impacts were not identified. Now, it is concluded that the colour change oddity does not have a grave impact on behaviour.

However, despite the initial reveals, many institutions have utilised this method in order to see a change in behaviour. For example, the 1990s saw a change in visiting team's locker rooms to pink in order to expect it to hinder the player's forcefulness, England jail cells were also painted pink (Sample, 2003). In 2006, 100-year-old Texas Correctional Facility, a sheriff of a five prisoner changed the colour of outfits, shoes, towels and inside walls in order to mortify the detainees and debilitate their arrival to the prison.

Confined spaces studies in Earth can also be utilised in the International Space Station (ISS) as they are relevant to test long-term habitation space flight modules and projected inflatable habitation modules for missions to outer space. Conventionally, the NASA used white for interiors of habitation modules, however with a relevant study on colour, NASA is now more subject to change in interior colours for the modules.

Dahlin (1999) suggested that the atmosphere of a room is greatly impacted by colours and this is determined by the light conditions of that room. According to him, lighter colour give a room a sense of openness and expand spaciousness whereas darker colours are to provide a stronger sense of space, also supported by Sundstrom (1986). Colour perception is often linked to its materials, especially in terms of architecture as characteristics associated with architecture are linked to structure, lustre, transparency which one is not able to psychologically determine in laboratories (Ibid.).

Office environments tend to have a higher preference to multiple bright colours according to studies (Hedge, 1982). Colour is often symbolically interpreted by employees and clients of that office; it can be referred to as a symbolic artefact according to Küller (1995) due to its emotional and physical effects on people, in support of Davis' model (1984).

Further research which specific to commercial sceneries suggest that colour of the walls affect the customer's evaluations (Babin, Hardesty, and Suter, 2003). Moreover, Guilford (1934) revealed that blues, reds and greens and other lighter colours are mostly preferred, moreover colour hues were considered and preferred more important than saturation or values. According to Jacob and Suess (1975) physiological and psychological effects are more effective by warm colours such as red and yellow than cooler colours like blue and green. Research has shown that green induces emotions like relaxation and comfort (Kaya and Epps, 2004). On the other hand, there is weak evidence with regards to empirical research on colours benefits on health in settings like health care (Dijkstra, Pieterse, and Pruyn, 2006).

According to Dijksta et al. (2006) the colour green on walls shown to have effects on stress, specific to individuals with lower ability to screen off unwanted stimuli, also in accordance with office employees and their performance level, they also showed poor performance in a red office versus blue or green than those with high ability to screen (Kawallek, Woodson, Lewis, and Sales, 1997).

The abundance of research has been linked to single, bright, monochromatic colours that require subjects to limited exposure in a real environment. Kwallek (1997) decided to study office workers over a full eight-hour workday for four continuous days as the impact of interior office colours on employees would change due to the longer exposure, thus decided to test this theory. Results displayed that value, saturation or interrelationship of the adjacent colours is contrasting the perception of office workers but the dimension of colour and its relationship to the environment was more significant than the colour.

Moreover, fewer researchers acknowledged the difference between individual responses to colour and to light; this individual difference is able to separate irrelevant stimuli that may impact how colours can affect a person's mood and performance. Mehrabian (1976) suggest that in the case of arousal response, individual differences may be the central

reason why people response to the environment in a particular way. Moreover, other research reveals that some individuals are able to be more distracted by irrelevant stimuli, this impacting their performance whereas other individuals actually improve performance with irrelevant stimuli while doing tasks. The explanation of these differences can be linked to the ability or inability to be able to screen out less important stimulation automatically. Those people who are able to easily remove less relevant stimuli of their environments are known as high screeners whereas the opposite are low screeners.

Literature review conducted on colour to help establish colours and colour combinations that would aid create spacious, pleasant, and productive environment for the NASA's habitation module displayed the several office colours; in one of the offices white colour showed very less productivity in workers more than other office colours and thus choosing the colour from the three monochromatic colour to be tested was also in order to aid NASA and informing the long-term effects of exposure to white in a relatively confined space.

In another office, utilisation of bright red colours and were contrasted with medium blue –green colours as colour schemes as it was found to be associated with negative effects. According to reports conducted by NASA, if office colour scheme with a vivid colour has the largest surface area, was predicted to create an ambience that is more confined, unpleasant and less conducive in terms of productivity. Literature citations on colour preference indicate that office workers prefer a light blue-green office colour (Brill, 1984, 1985).

2.12.5 Sensory Change and Variability

People tend to respond well to sensory change and variability just like they prefer to see nature, daylight, and have a view. Lack of visual stimulation can lead to dullness and difficulty concentrating. The monotonous nature of the workplaces these days there is dull walls and other dull features tend to negatively impact productivity (Stringer, 2013).

By sensory changes, they don't mean there needs to be brighter rooms or lighting but rather more natural changes like a view and windows that give access to light, etc. to create visual complexity with a combination of these factors to promote productivity

(Heerwagen, 2000). If people don't experience ample stimulation, they get bored, and as a consequence, their productivity is compromised (Cooper, 1968).

2.12.6 Noise Control

Depending on the type of work performed in addition to personal preferences, noise can be either beneficial or hinderannnce to productivity and therefore is quiet the prevalent problem in the workplace. The key to handling this problem is having access to quiet rooms when need be (Stringer, 2013).

In open offices, there is a chance of perceived noise, often this happens as a result of the arrangement of the office, the materials used in the interiors as well as the nature of the work. People are more productive and happy when they have control over the noise in their surroundings (Kjellberg et al. 1996). Despite the fact that people think of noise as negative, the right amounts of it can stimulate people in some tasks and keep them motivated. While this might be the case for some tasks, more complex work when interrupted is often not a good thing as it takes people a while to reorient themselves and get back on task (Zijlstra et al. 1999).

According to U.S. General Services Administration (2011) "office acoustics is a key contributor to work performance and well-being in the workplace. The ability to find quiet times and places are essential to support complex knowledge work, while the ability to have planned or spontaneous interactions without disturbing others is necessary for teamwork and relationship development. Having speech privacy is necessary for confidential interactions and work processes. 'Acoustical comfort' is achieved when the workplace provides appropriate acoustical support for interaction, confidentiality and concentrative work."

2.12.7 Human Factors and Ergonomics

Long term, people tend to be more productive and comfortable working in offices that are designed to cater to their needs and around them. This is because, when taking into account "human factors" they are considering factors such as ergonomics, workplace

safety, the reduction of human error, product design, human capability and human-computer interaction (Stringer, 2013). Therefore the terms “human factors” and “ergonomics” are often used interchangeably.

American association of orthopaedic surgeons have found that there are more people in the USA that suffer from musculoskeletal problems such as back pain, arthritis and other related diseases than in any other region. In 2004 alone, over $849 billion worth of losses were incurred as a result of musculoskeletal diseases. This accounts for 7.7% of the GDP of USA (Stringer, 2013).

HOK recently conducted a social media based survey that questioned over 3600 employees in several industries. A surprising 82% of them reported to suffering from work associated physical problems. Among these, the most common problems reported were a pain in the neck, back and shoulder as a result of people sitting around all day perhaps. Furthermore, a third of those surveyed reported that they had headaches and eyestrain and those who did more standing jobs reported hip, leg and foot pain. The conclusion from the survey was that sedentary life or poor ergonomics was to blame for the problems reported (HOK, 2012).

Statistics from the American cancer society reported to the American Journal of epidemiology that men who sat down for longer periods of time on average, for about 6 hours more than those who were more active lived 20% shorter lives and women who sat down for longer periods had a 40% shorter life in contrast. Even exercising regularly had no effect on these findings (Bernstein et al. 2010).

2.13 Research gaps

Based on this literature review the following gaps in the research have been found:

- There is no existing empirical research using socio-cultural characteristics of the workers. However, authors such as Horayangkura (2012) argue that this should be one of the most critical considerations during planning for workplaces. This is particularly relevant in the case of Saudi Arabia with its socio-cultural values heavily influenced by common principles guided by Shariah. The monotony of

Saudi culture requires consideration of these cultural values to be used for designing appropriate workplaces.

- None of the past research has focused on gender aspects of workplace design. This could be because most of the existing research have been conducted in developed nations which do not have the gender segregation like in Saudi Arabia. It is essential to consider gender aspects because there could be clearly different needs of workers based on their gender.

- Past research has mainly on workplace design without focusing on nature of job except for the research conducted for nursing and health. But researchers have acknowledged that characteristics of the work must be accommodated in the design. Education institutions are present around the world and they make a significant contribution to human society. Yet, no research has been conducted on workplace designing for academicians. Like suggested by researchers looking at other sectors, nature of work mediates the impact of workplace design on productivity. Considering this it is essential for us to carry out a research a research on workplace designing for academicians.

This research thus fills three gaps- it focuses on gender-based, culture-based and professional based perspective on workplace designing. Authors such as Koger and Winter (2010) Horayangkura (2012) have recommended utilising learning from diverse fields such as psychology, environmental psychology, sustainable development, culture etc. in the field of workplace designing. This Research thus extends the existing literature and proposes that these three perspectives should be taken into consideration while designing workplaces. Saudi Arabia is particularly relevant in this case because Saudi government has been pumping in millions of dollars to build new universities especially focused on technical education and women education.

Based on the literature review the following conceptual framework has been conceptualised:

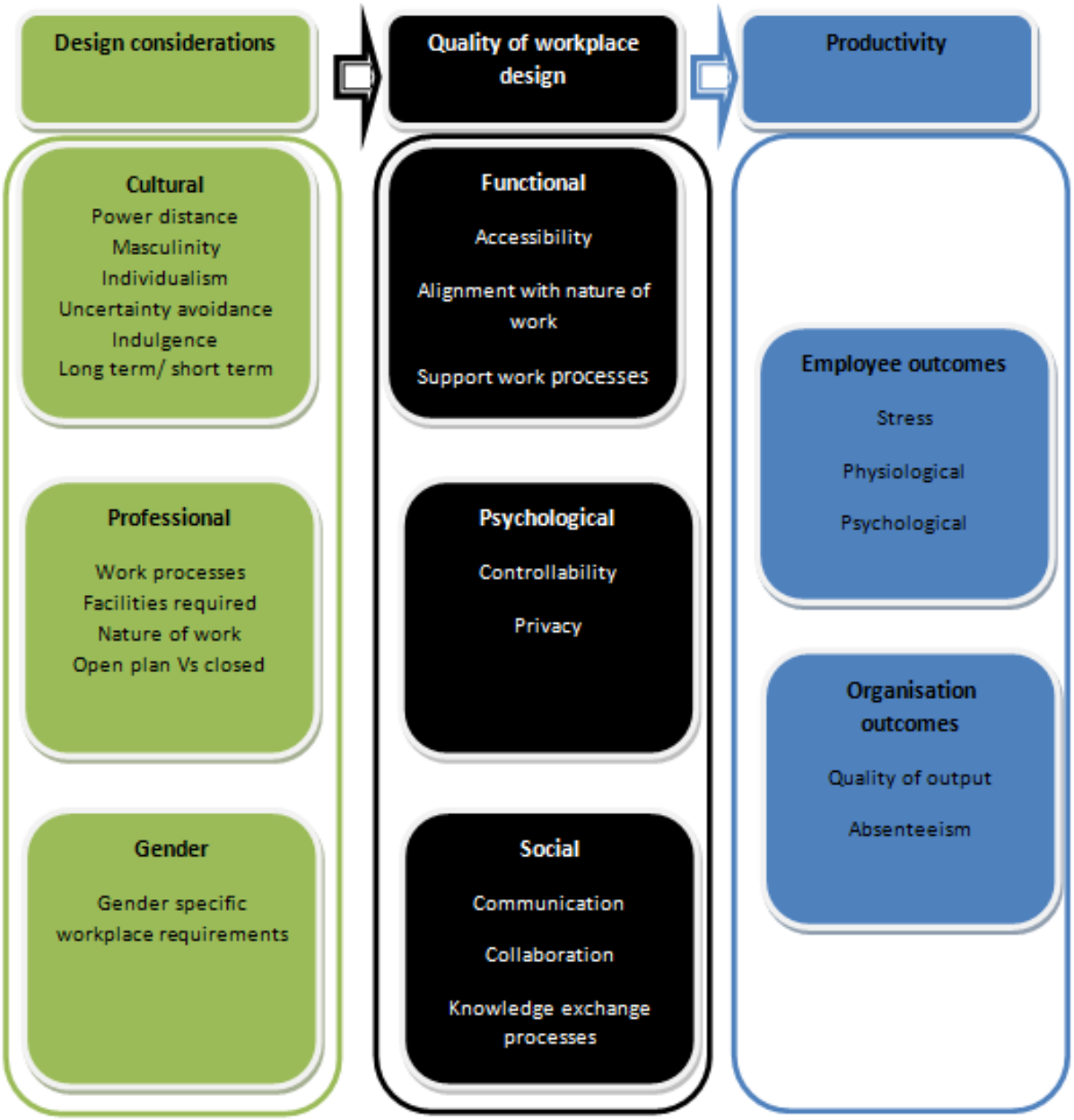


Figure 8: Conceptual framework

This framework conceptualises that the three aspects of design considerations i.e. gender, profession and culture of the occupants affect the three aspects of perceived quality of workplace design i.e. functional, psychological and social. These three aspects of perceived quality of workplace design affect the two aspects of employee productivity i.e. employee and organisational outcomes.

3. Methodology

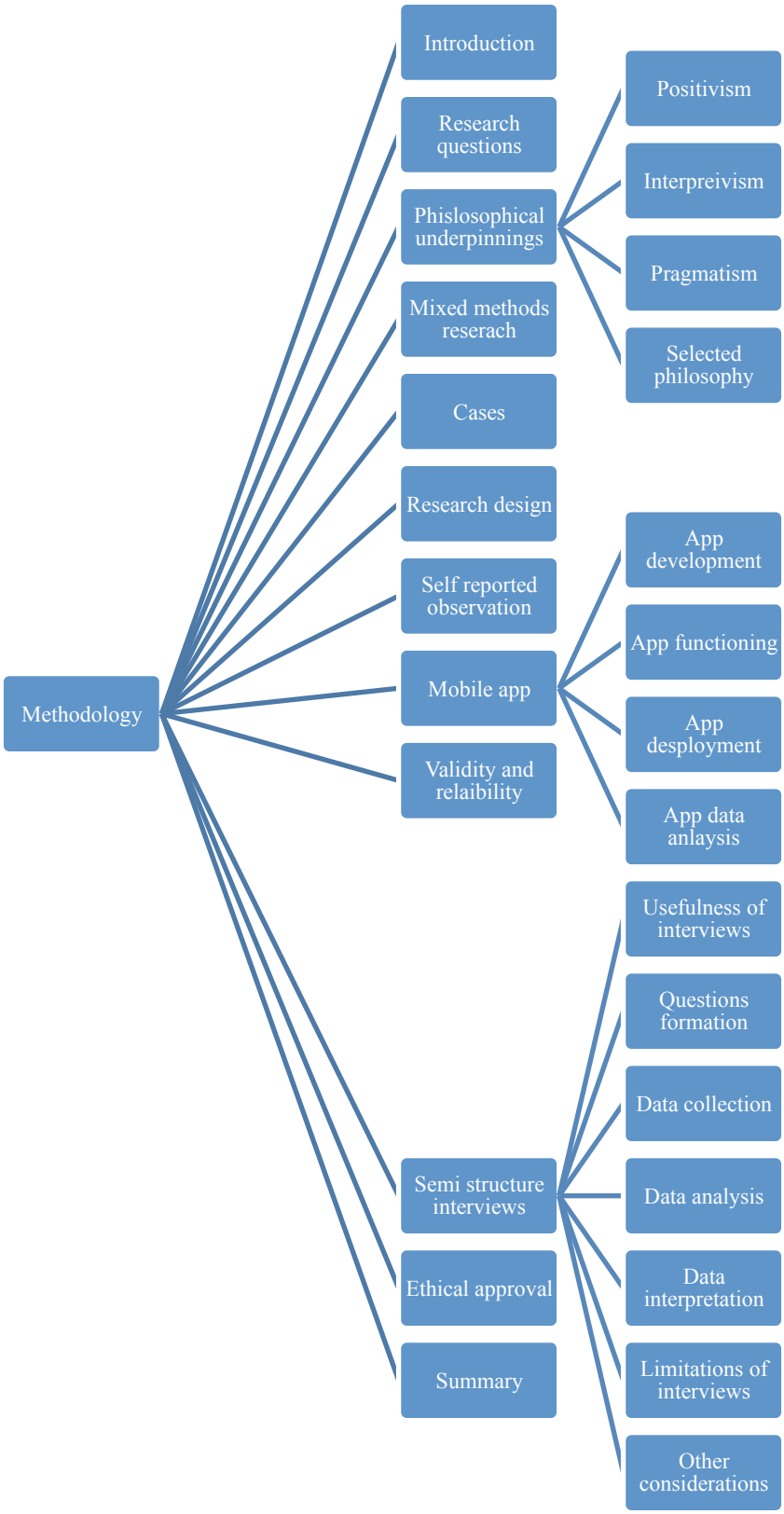


Figure 9: Chapter 3 structure

3.1 Introduction

Research methodology is driven by the research questions. The nature of research questions, as well as author's perception of the data and its availability, also affects the choice of research methods (Saunders et al. 2015). This research aims to fill several gaps in the research. This research aims to understand the influence of cultural, gender and professional factors on the relationship between workplace design and employee productivity. While past research has concluded that consideration of cultural, professional and gender aspects in workplace designs do affect employee productivity but past research have not tested these relationships empirically. Hence the key aim of this research in terms of methodology is to empirically test the impact of cultural, professional and gender aspects in workplace designs on employee productivity.

This particular chapter is concerned with the methodology adopted for collecting and analysing data. One of the novel contributions of this research is the introduction of a new data collection method. The need for this data collection arose from the uniqueness of the nature of data required for this research.

3.2 Research questions

To embark on this research, it is important to consider the role of the research questions to be able to provide guidance in this research process (Cohen et al., 2011).

As discussed in the literature review it is essential to consider the specifics of the occupants and occupation when designing workplaces because the needs, expectations and behaviour of occupants could significantly depend on their own profile as well as the nature of their job. Broadly speaking this research aims to investigate whether designers are using relevant information to inform their design decisions using all-female universities in Saudi Arabia as a case study. At the same time, this research aims to understand how contextualisation of the design of workplace affects the productivity of the employees.

Bassey (1999: 67) defines research questions as “the engine which drives the train of enquiry.” Robinson and Lai (2006) also define it as the anchor for planning a research

because they provide important clues on how to make research decisions. The questions for this research were formulated within the professional/personal contexts (Plowright, 2011). As a Saudi Arabian female looking to work in Saudi Arabian University as a professor, researcher was looking to find a way to make a personal as well as academic contribution through her research. Researcher, through her frequent interaction with teachers in Saudi Arabian Universities, had learnt a great deal about the workplace challenges that female academics face in Saudi Arabia. Several of these challenges are part of the job but there are some challenges which can be overcome through careful management. This is essential because the researcher understands, and the literature agrees, that managing workplace is critical for an effective workforce. Workplace management begins with workplace design because it is the surroundings that humans interact with first before beginning to interact with other individuals. Furthermore, individuals continue to interact with their workplace environment and this undoubtedly has an impact on their productivity. However, it is unclear which aspects have an impact on the productivity. This has largely remained uncovered because of the researchers' propensity to generalise. This research is based on the view that contextualisation rather than generalisation is critical for understanding the relationship between workplace design and employee productivity.

The research questions in this study influenced the methods that are used to collect data to answer those questions. In order to establish the kind of data required to answer the research questions, it was important to decide what appropriate methods will be used to investigate the research questions. As the aim of this research is to explore the impact of workplace design on employee productivity in context of female academicians teaching in Saudi all-female universities, the research focuses on one aspect of the debate and that is how to accurately measure the extent to which workplace design affects productivity because the latter could be affected by several additional factors. So the question is how to estimate to which extent this workplace design affects employee productivity. Another question which emerges in this respect is what is meant by the productivity of teachers. Also critical is to understand how the gender, profession and culture of the occupants affect the satisfaction that workplace occupants derive from workplace design. Answering these questions is central to this research. The figure below shows the research design for this research:

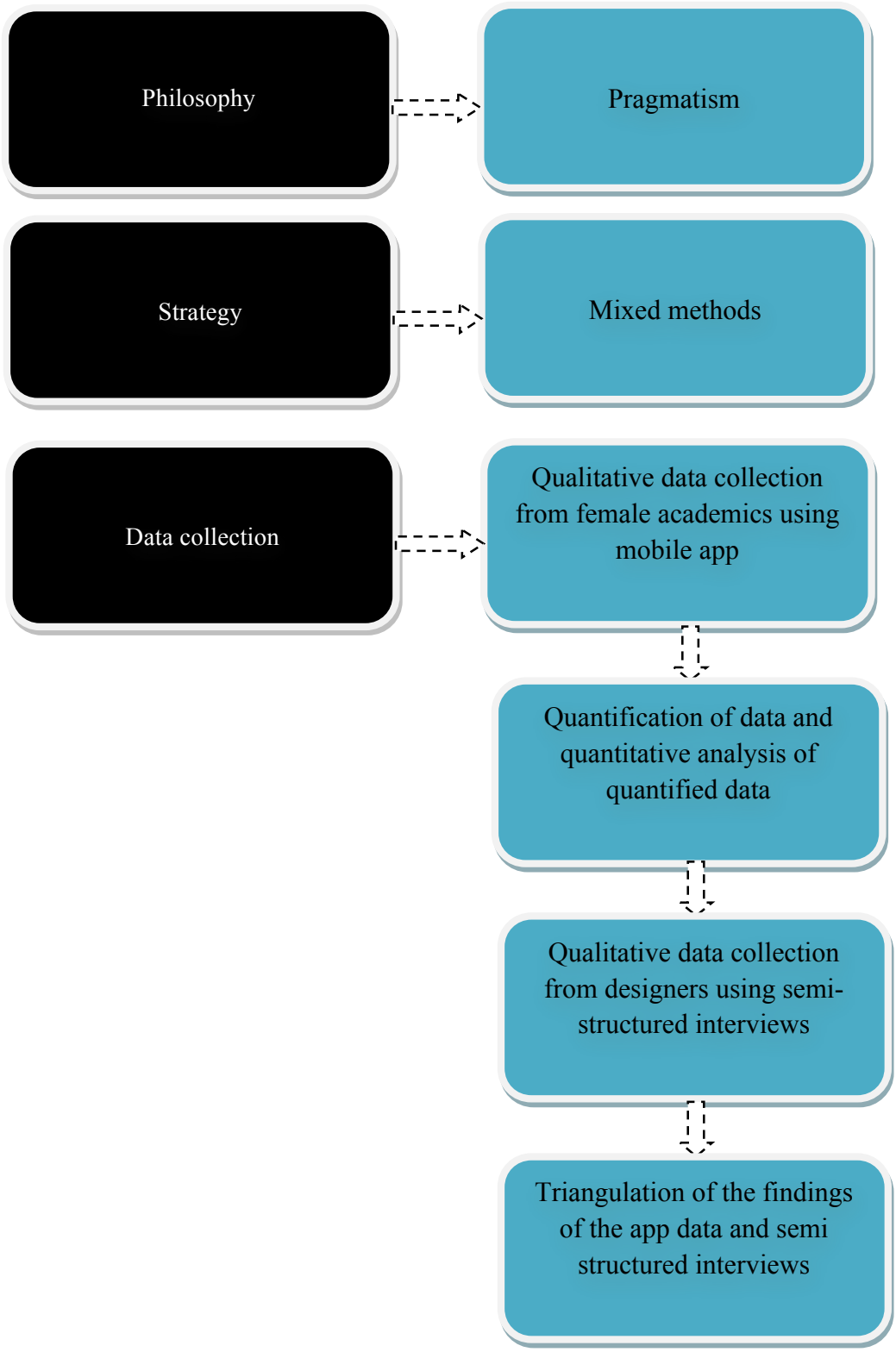


Figure 10: Research design for the researc

3.3 Philosophical Underpinnings of Mixed Methods Research

This research is based on pragmatist view of the world which states that our preconceptions about a problem can sometimes mislead us and what we require is an open approach towards findings solutions when we approach a problem. This open worldview is useful especially is the researcher is researching a subject with somewhat fuzzy boundaries. This research and the lack of any prior research on this side of the issue requires the researcher to focus on the research questions to determine the research framework rather than questioning the ontology and epistemology as the first step of the research (Wahyuni, 2012).

There has been a lot of debate on the suitability of combining quantitative and qualitative methodology despite several authors claiming that doing so will help in overcoming the weaknesses of either of the methodologies with the strengths of the other (Creswell, 2010, 2009; Johnson, Onwuegbuzie and Turner, 2007).

Pragmatism simply offers the researcher freedom to use interpretivist or positivist philosophy as required rather getting fixated in identifying the research philosophy. This seems reasonable because researcher's assumptions can sometimes be based on limited knowledge and may prove wrong when actual data collection and analysis is operationalised. Positivists believe in a definite worldview and recommend using methods which will confirm the solution either way. Interpretivists base their multiple worldview perspectives on a constructivist approach. This research contends that researchers should be able to choose whatever paradigms and methods they need or desire to use to conduct a research.

3.3.1 Positivism Paradigm

The epistemological and ontological stance of positivism suggests that reality is external to the researcher and the truth about this reality can be obtained because knowledge rests on a set of firm, indisputable truths from which our beliefs may be realised (Mack, 2010). The researcher is thus completely external to the phenomenon and his/ her views and beliefs about the phenomenon being studied do not affect the findings (Kincheloe and Tobin, 2009; Brannick and Coghlan, 2007).

In addition, positivists are of the opinion that there are truths to be uncovered in this world and the best way to discover these truths is to use scientific techniques and methods. These methods and techniques aim to measure, quantify or find the extent of the phenomenon (Mukherji and Albon, 2010). Some of these methods are questionnaires, structured observations and techniques are experimentation and surveys. The researcher identifies a set of hypothesis or research questions and the methods that will be used to collect numerical data. These data are then analysed to prove or disprove the researcher's hypothesis or answer the research questions (Naughton, 2010). Positivist researchers consider it to be of primary importance to state one's hypotheses and then test those hypotheses with empirical data to see if they are supported (Johnson and Christensen, 2014).

In quantitative research, the results are not affected by the context and can be generalised over time (Bassey, 1999). For this research, the positivist approach was considered because the researcher decided to utilise numerical analysis. However, the Positivism approach is not very comprehensive enough on its own for this research because it does not provide means to examine human experiences, perceptions and behaviour in an in-depth manner. This is because the aim of this research is to explore how workplace design affects the productivity of female academicians working in all-female universities in Saudi Arabia. It is quite difficult to measure the key aspects of this research quantitatively because it is almost impossible to structure a questionnaire which will accurately reflect the relationship between workplace design and employee productivity. However, it is essential to generalise because workplaces are communal spaces and it is not possible to design workplaces according to individual tastes and needs at least in the context of universities. Thus, it was considered essential to achieve some degree of generalisation in the findings. This was done using an innovative approach which is actually a mix of observations and self-reported questionnaire except that there were no specific questions for the respondents to report. More on this is explained later in this chapter.

However, quantitative data alone was not sufficient for this research because the limitations of quantitative methods mean only certain amount of information could be included in the quantitative research. Qualitative research was used to obtain in-depth insight into the perspectives of both the designers and the teachers on this issue. The researcher has to immerse herself in the situation to get a good understanding of the

context. Therefore, it is pertinent to say that this research has an interpretivism aspect to it.

3.3.2 Interpretivism Paradigm

Qualitative research is built on the interpretive foundation (Mukherji and Albon, 2010). Interpretivists believe in the existence of multiple realities (Wahyuni, 2012) and in employing subjective methods to learn about all realities. In order to learn about these multiple realities, the researcher needs to develop a direct contact with the individuals who can inform him/ her about the realities from their own perspective (Johnson and Christensen, 2014; Mack, 2010). There could be as many realities as there are respondents (Pring, 2000) but ultimately, reality or truth is built in a social context (Sale et al., 2002). In addition, the epistemological stance of interpretivism reflects on its nature that is it emphasises gaining detailed insight into an issue (Mukherji and Albon, 2010). It acknowledges that the researcher is not independent of what is researched (Miles and Hubberman, 1994). It pushes the necessity for the researcher to understand the differences between humans in social actor roles. The interaction between the researcher and participant can uncover deeper meaning in what is being researched. Axiologically, interpretivists take the stance of the participants' perspectives (Johnson and Christensen, 2014). The experiences and values of the researcher and the participant influence the collection of data and its analysis (Wahyuni, 2012).

Unlike positivism, interpretive research does not make use of standardised research methods and techniques; rather it makes use of less structured methods and techniques such as ethnography, open-ended observations, interviews and phenomenology that are usually in form of words (Lor, 2011). Interpretivists are against the use of standardised research techniques because they criticise objectivity in research instead they prefer to ask questions, record what has been observed, collect the data and make interpretations (Johnson and Christensen, 2014).

One of the weak points of interpretivism is that it does not lead to generalisation except for the context in which the problem is studied (Mack, 2010). One of the ways to achieve generalisability in qualitative research is to study the same problem in several different contexts (using multiple case studies) and evaluate if the findings can be generalised by comparing the findings from several different case studies. This research also sought to achieve some level of generalisation using multiple case studies.

Weirsma (2000: 211) recommends that "a well organised, complete persuasive presentation of procedures and results enhances external reliability." Mack (2010) recommends improving the reliability by adopting quantitative methods when analysing the data. This research adopts his recommendation; researcher quantified the qualitative data obtained through self reporting by the teachers. This quantification helped the researcher in analysing the data is a manner which improves its reliability. There are some issues with the reliability of the data in terms of how it was quantified. This was overcome by the involvement of some external participants as discussed later in the chapter. Involvement of external agents also helped the researcher in overcoming the researcher bias, which according to critics is one of the key drawbacks of interpretive research (Mack, 2010). According to Johnson and Christensen (2014), one of the problems with qualitative research is selective observation and selective recording of information and also allowing personal views affect how the research is conducted and how the data is interpreted. They recommend using reflexivity and negative case sampling techniques for overcoming this drawback of qualitative research.

The different nature of the research approaches and paradigms discussed above brought about the debate that they should never be combined because of their epistemological and methodological differences. For example, Smith (1983) argues that the two methods should not have different epistemological implication and therefore researchers should not accept the unfounded assumption that the methods are complementary. Huges (1990) and Smith and Heshusius, 1986) add to this stating that the research methods are divided by ontological and epistemological commitments and therefore they should not be combined in any way for research inquiry. However, this study shows that quantitative and qualitative research can be combined to enable a researcher to collect appropriate data.

Another major difference between quantitative and qualitative research is their area of data collection and analysis. Quantitative research relies on numerical data and statistical analysis (Gall, Gall and Borg, 2002); however, qualitative research makes use of written data and subjective analysis (ibid). This shows that there are certain questions and topics that quantitative research will not answer and the same goes for qualitative research. Therefore, taking a pragmatist approach allows the researcher to mix methods from both research approaches that will offer the best chances of answering the research questions. This research will justify why a combination of qualitative and quantitative methods are

important for the data collection in this study. This research is based on the view that qualitative and quantitative methods have their own advantages and disadvantages and combining the two can help overcome the drawbacks of both the methods. While qualitative data can provide the insight quantitative data can help generalisation. This is particularly critical for this research because insight is required to understand the perspectives and experiences of the respondents while generalisation is critical to understand at a general level what people require from their workplace designs.

3.3.3 Pragmatism

Pragmatism supports mixed methods approach which has been accepted as "one best" worldview because of its proficiency to draw on multiple ideas that work and its flexible ways in combining different methods (Denscombe, 2008). It supports the perspective that researcher should focus on answering the research question and use method suitable for the research questions rather than pre-emptively deciding which method should be used to answer all the research questions (Wahyuni, 2012; Suter, 2005). Pragmatists adopt a methodological pluralistic approach (Johnson and Onwuegbuezie, 2004). Because pragmatic research utilises mixed methodologies with the same inquiry, they are able to delve further into a dataset to understand its meaning and to use one method to verify findings from the other method (Onwuegbuzie and Leech, 2007).

The current debate about quantitative and qualitative research methods has had researchers taking sides instead of accepting that any methods or paradigms can be used for research. Consequently, pragmatism is not devoted to a single philosophy, therefore, mixed method researchers are free to choose what paradigms, methods, procedures and techniques that best meet the needs of the research purposes (Cherrholmes, 1992; Murphy, 1990). Pragmatists ascribe to the philosophy that the research question should drive the methods used, believing that epistemological purity does not get research done (Johnson and Christensen, 2014; Onwuegbuzie and Leech, 2005). Being a pragmatic researcher gives room for flexibility in investigation techniques that attempt to address a selection of research questions that arise (Onwuegbuzie and Leech, 2007).

The aim of this research is to investigate the impact of workplace design on employee productivity. This research is a mixed methods study which is underpinned by the

pragmatists' paradigm. As a pragmatist researcher, this research is in a better position to use the quantitative portion of the research to inform the qualitative portion (Onwugbuezie and Leech, 2007). This research is driven by the methods to answer the research questions (Johnson and Onwuegbuzie, 2004; Miles and Huberman, 1984). Therefore, the researcher developed a novel conceptual framework which was used to design a quantitative approach in which results data collected will be analysed numerically. The self-reporting app with academicians and interviews with the designers were designed to follow the quantitative approach sequentially to explore in more detail the quantitative findings--**Explanatory Sequential Design**. Combining a number of research methods is one of the benefits of pragmatist research which this research aimed to benefit from.

In addition, for this study qualitative method is appropriate because it will help the researcher gain insights into an under-researched field of the role of culture, gender and profession in shaping the relationship between workplace design and productivity of employees. It would be almost impossible for respondents to accurately quantify how their productivity is influenced by workplace design. This is because humans continuously interact with their surroundings and it continues to affect their productivity. This continuous interaction cannot be accommodated in a structured questionnaire and hence a continuous mode of data collection was required. The researcher therefore had to think of an innovative way to get this continuous self-reported data and then to convert it into the quantitative format. Quantification of this data is essential in order to understand two things:

- Can we say for certain that workplace design affects employee productivity for Saudi Arabian female academics?

- Is it possible to generalise that gender, profession and culture of the Saudi female academics influence how their productivity will be influenced by the workplace design?

The generalisation required answering the questions above warrants the use of quantitative methods. At the same time, there is no quantitative measure of how culture, profession and gender of occupants influence the designers' consideration when designing a workplace. This need to be explored through qualitative interviews or focus groups where respondents can tell, in their own words how workplace design affects their

productivity and how designers consider the various ways in which individuals interact with their workplace when designing workplaces.

It will not be useful for measuring teacher's productivity because it does not recruit standardised research methodologies; instead, it gives room for only less structured techniques. Therefore the researcher employed the use of both quantitative approaches to be able to measure the levels of engagement and qualitative approach to have a deeper insight on what is observed so as to explore the similarities in the data collected. This will enable the researcher to delve further into a dataset to understand the nature of this research and to use one method to verify findings from the other method (Onwuegbuzie and Leech, 2007). Furthermore, one of the weaknesses of qualitative research is the ability for the results to be easily influenced by the researcher's personal biases. However, with the quantitative method which prevents researcher bias, the strength of the quantitative method in this research overcomes the weakness of qualitative research. The results from the quantitative research if similar to the quantitative results can improve its validity and reliability. It is, therefore, pertinent to say that a mixed methods approach is suitable for this research because it makes use of both standardised techniques and less structured techniques.

Feilzer (2010) suggests that there is a chance that mixed methods design leads to cumbersome findings so that the various methods complement each other rather than lead to conflicts. In this respect, Greene at al., (2001) suggests that designing, analysing and discussing mixed methods research requires carefulness and reflexivity.

3.3.4 Research philosophy selected for this research

Epistemology is concerned with the relationship between the learner and what is known (Biddle and Schafft, 2014). Blaikie (2000) defined epistemology as the possible way of gaining knowledge of social reality, whatever it is understood to be. It is also been described as the relationship between the researcher and the known world (Palaiologou, 2013). Positivists believe that the learner and the known are independent, whereas interpretivists/constructivists believe that the learner and the known are inseparable (Wahyuni, 2012). The epistemological position underpinning the mixed methods approach is that knowledge is subjective and is generated through critical appraisal of

multiple sources (Wahyuni, 2012). The epistemological stance of pragmatism reflects its nature that is it emphasises collecting data that works to address the research questions (Creswell and Plano-Clark, 2007). Therefore, this research makes use of both quantitative and qualitative methods to address the research questions.

Axiology is the branch of philosophy that is concerned with the role of the researcher's values in the research process (Tomar, 2014). Values affect how research is done and the how the results of the research are valued. Positivists believe that inquiry is value free while interpretivists/constructivists believe that inquiry is value bound (Lincoln and Guba, 1985). The axiological perspective underpinning a mixed methods approach accepts that many "goods" may emerge from the research, and that "propositional knowing about the world as an end in itself, is intrinsically valuable" (Guba and Lincoln, 2005: 198). Although the researcher will make attempts to remain neutral and not influence the outcomes of the research, any value held by the researcher will have an impact on the delivery of the research (Hart, 1995). Therefore, the values of the researcher may have an impact on the execution of the research. It may also influence the focus and the outcome of the research. As the purpose of this research is to investigate the impact of workplace design on the productivity of female academicians working in Saudi Arabian all-female universities, the value for this research translates directly to an improvement in workplace design so as to facilitate and support the female teachers teaching in Saudi Arabian all-female universities. By identifying the relevant values, the researcher will try to prevent them from becoming a barrier while conducting the research. Although steps will be taken to minimise the influence of the researcher, it is implausible this will not occur. However, the researcher can prevent them from becoming a barrier and support the development of the structure of the research design by identifying the relevant values.

Ontology helps researchers to understand different ways of viewing the world (Thomas, 2009). It is the nature of reality and how researchers understand it (Biddle and Schafft, 2014). The ontological position underpinning mixed methods research is that of critical realism where reality is 'imperfectly and probabilistically apprehensible' (Guba and Lincoln, 2005; 193). Also, the ontological stance of pragmatism suggests that there are

singular and multiple realities that are open to empirical inquiry (Creswell and Plano-Clark, 2007) and orients itself towards solving practical problems in the real world (Feilzer, 2010:8) rather than focusing on assumptions about the nature of knowledge (Hall, 2012). Therefore this research seeks to find how workplace design affects the productivity of female academicians teaching in Saudi Arabian all-female universities. The findings from this research will solve issues in the real world by identifying ways to improve workplace design in order to support the work of female teachers teaching in Saudi Arabian all-female universities.

3.4. Mixed Methods Research

Many researchers have attempted to define 'mixed methods' but only a few were chosen for this research. Teddlie and Tashakkori (2010:5) defined it as "the broad inquiry logic that guides the selection of specific methods and that is informed by conceptual positions common to mixed methods practitioners". A broader definition was provided by Creswell and Plano Clark (2007:5) and they defined mixed methods as follows:

> *"Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in combination provides a better understanding of research problems that either approach alone."*

Creswell (2012) defined it simply as "a method that focuses on collecting, analysing and mixing either quantitative and qualitative data in a single study or a series of studies to understand a research problem." Creswell's definition indicates that qualitative and quantitative data collection and analysis are present in a mixed methods research. Mixed methods work beyond quantitative and qualitative exclusivity which integrates both qualitative and quantitative methods and numeric and narrative data to meet the needs of the researcher and tackle research questions appropriately (Teddie and Tashakkori, 2009; Johnson et al, 2007). In this research, the author collected only qualitative data from both sets of respondents (teachers and designers) but the difference was in the method of data analysis.

Whilst this study is focused explicitly on mixed methods, it is recognised that there is a lack of consistency in the language used to describe the combination of different methods in a single study. The term 'mixed methods' may entirely be applied to a study using both quantitative and qualitative methods. Although the term is commonly used to describe the use of both quantitative and qualitative methods, it can also be applied to studies which involve different quantitative methods only such as questionnaires and surveys and qualitative methods only, such as observations and focus groups (Barbour, 1998; Morse, 2003).

The goal of mixed methods research in this study is to draw from the strengths of both qualitative and quantitative methods in a single research and not to replace either of these approaches (Johnson and Onwugbuezie, 2004). Yin (2009:63) puts forward that "mixed methods research can permit investigators to address more complicated research questions and collect richer and stronger array of evidence that can be accomplished using a single method alone." For example, in this research, it is essential to look at the concept of productivity from the perspective of the teachers while the design considerations are looked at from the perspective of the designers. This is so because having some recommendations from the teachers alone will not be sufficient because designers may face constraints in designing workplaces. Since only designers know what challenges they face and what considerations they make during designing, it is essential to take their perspective into consideration.

Mixed methods approach is essential in circumstances where neither quantitative nor qualitative methods alone would be adequate to answer the research questions. The major advantage associated with mixed methods in this research includes the clarification and comparison of results from one method with another method but a researcher has to be very careful at this stage. It allows for the results from one method, in this case, structured observation; help inform the structure and type of questions for the open-ended observation. Therefore, this approach is suitable for this research because it is based on the idea that the use of quantitative and qualitative approached, in a combination, will provide the researcher with a better understanding of the research problem than either approach alone can provide. This better understanding will result from the fact that a mixed method research offers strengths that make up for the weaknesses of quantitative and qualitative methods if applied separately. There are four major types of mixed method designs and they are Triangulation design, embedded

design, explanatory design and exploratory design (Creswell and Plano-Clark, 2007). On that account, this study will be making use of the explanatory sequential design.

The **explanatory sequential design** as discussed above is a mixed method approach whereby the qualitative results connect to the quantitative results (Creswell and Plano-Clark, 2007). The design starts with the gathering and analysis of quantitative data followed by the gathering and analysis of the qualitative data. The second phase which is the collection of qualitative data is designed to connect with the results of the quantitative phase (Creswell and Plano-Clark, 2007). Due to the nature of the research questions stated in section 3.2, neither qualitative nor quantitative methods alone can make a satisfying picture of exploring the levels of impact of workplace design on employee productivity. Both quantitative and qualitative research has their strengths and weaknesses (Creswell and Plano Clark, 2011).

For this study, structured observation will be used to explore how workplace design affects the productivity of female academicians teaching in Saudi all-female universities. Similarly, semi-structure interviews will be used to understand how culture, profession and gender of occupants is considered during design considerations by designers.

Quantitative data was collected using a novel data collection method including a mobile app which was specifically designed for this research. The data obtained from the app was in qualitative format but the researcher converted it to quantitative format for purpose of analysis. This is explained in detail later on in section 4.1. This was followed by a qualitative method in which the researcher conducted semi-structured interviews with the designers. Thus the researcher has qualitative data from both the designers and the teachers but the data from latter is analysed both qualitatively and quantitatively. When the data for both methods are collected and analysed they will be compared. This will help the researcher to explain and expand the quantitative data thereby removing bias and improving its validity. The researcher needs the qualitative data to explain the quantitative results and add insights to them.

3.5 Cases

As outlined earlier, the aim of this research is to examine the impact of workplace design on teacher's productivity in all-female Saudi Arabian universities and one of the key arguments for this research is that workplace productivity is highly contextual. Contextualisation requires understanding how the productivity is shaped by workplace designs for Saudi female academicians. This would require contextualising as per the gender, profession and culture of the individuals.

Now that the research questions have been formulated, it is clear that the research will involve one or more sources of information. These sources will provide the data for this research. Cases according to Plowright (2011) capture the wide range of data sources that are used in research. The first level of cases is referred to as Data source management which decides the approaches that are going to be used for managing the sources of data.

There are three approaches that are used for managing the sources of data and they are a case study, experiments and surveys. In this research, the case study approach was used. A case study approach is a type of research that involves the study of an issue explored through one or more cases within a bounded system (Bryman, 2008; Creswell, 2007). Greene et al. (2005) state "that case studies are seen to merge methods that gather and represent human phenomena with numbers (such as standardised questionnaires) along with methods that gather and represent human phenomena with words (such as open-ended interviews and unstructured observations." A case study will be suitable for finding out more detailed, subtle complex interactions between workplace design and employee productivity within a narrowly defined context in all-female Saudi Arabian university (Robert-Holmes, 2011).

The decision to selecting case study approach derived from the fact that the research focused on female universities from Kingdom of Saudi Arabia where there was an in-depth data collection involving more than one sources of information (self-reported observation and semi-structured interviews). These case studies allowed the researcher to understand how specifics of the job, culture and gender affect people's interaction with their workplace and consequently their productivity. It was employed so as to capture the voice of the employees.

According to Plowright (2011), there are a number of characteristics that identify a case study and they are: Number of cases in research, Degree of control and Ecological validity.

3.5.1.1 Number of cases

When carrying out a research, it is important to take into account the number of cases in the data source. There are a number of issues that are associated with the number of cases in a research. These issues are methodological and logical. Methodological issues include the amount of in-depth detail that can be gathered from the cases and the degree of generalisability that can be made about the inferences from the data collection (Plowright, 2011). The more cases are drawn from the data of a research, the more limited the amount of in-depth gathered from the data. Therefore, for this research, there will only be a few cases which will, in turn, provide a large amount of in-depth detail. However generalizability is restricted and limited. However, this research is still a multiple case study research with data being collected from three all-female universities in Saudi Arabia. The reasons for selection of these three case studies are:

There are three types of case study and they are single instrumental case study, collective or multiple case studies and the intrinsic case study. This study is a multiple case study because it will be focusing on an issue with a number of cases. These case studies take place at three different all-female universities in Saudi Arabia. Using more than one case will help in identifying if there is any sort of generalisation in the findings. Colleges and universities are not developed for one individual but for hundreds of teachers and students to interact for the development of collective knowledge. Hence it is not wise to take any biased view while designing universities. It is thus, useful to achieve some sort of generalisation when conducting research on workplace designing for universities. This generalisation is also possible because of the consistency in the operations and occupants of universities; it is almost always used by teachers and students for teaching and learning. In the case of Saudi all-female universities, there are two more grounds of generalisation and that is gender and culture. Using more than one case study is useful in this regard to eliminating factors related specifically to one university but not to universities in general. Hence this research utilises multiple case study design.

All three are all-female universities providing the same kind of courses for Saudi females. The identical cases will increase the sample size which will help the researcher achieve generalisation. Multiple case studies help cross verification of data. In this research, there is a possibility that one of the universities selected was designed a while back and with time designing of universities may have improved. Using three universities designed within last decade means that the data collected is relevant for designing future universities.

3.5.1.2 Degree of Control

This has to do with how much control the researcher has over the cases that are allocated to groups in a research. Plowright (2011) argues that in a case study, the researcher has limited or no control over case allocation to groups because a case study usually consists of a few participants. In this research, the researcher aimed to collect data from as many participants as possible so the focus was on maximising participation of participants rather than on allocation of groups to cases.

It can be argued that this research may be a survey or an experiment but it is not. This is because this research is not collecting general information from a large number of participants and it is not manipulating the conditions under which the participants operate. Instead, the researcher has allowed the individuals to self-report as per their convenience. What is interesting is that researcher will get the comments from the respondents in real time even though researcher is not directly interacting with them or is not observing them. This ability to collect real-time information is one of the primary contributions of this research.

3.5.1.3 Ecological Validity

This refers to the degree of naturalness of the research location and situation (Plowright, 2011). A case study approach to data source management uses a naturally occurring situation which is not constructed for research purposes. It is important for the researcher to know that the research should not interfere in the natural situation occurring in the

university. Therefore for this research, activities were not be disrupted nor the situation is created for the purposes of the research. Researcher downloaded the app on respondents' mobile phone and they were then left on their own to report the data to the researcher. The researcher did not interfere with the daily work of the respondents in any way and the system was so designed that the respondents initiated contact with the researcher whenever they felt the need to report anything relevant. This resulted in relatively high levels of ecological validity.

3.5.2 Sampling strategy

The main goal in choosing the study sample is to obtain information about the study population. So, the sample must be representative of the study population. The researcher cannot observe every teacher in the Saudi Arabian all-female universities so instead, she gathered data from a subset of the population. Similarly, designer considerations cannot be observed especially the ones from past projects. There are two types of sampling and they are probability sampling and non-probability sampling (Fogelman and Comber, 2007). Probability sampling involves random selection while non-probability sampling is a selection that focuses on a particular group with this knowledge that it does not represent a wider population (Cohen et al., 2011).

In this study, a non-probability sampling was chosen as the sampling approach because the choice of cases in this research was not a random selection, but on criteria that provided a sample that met the particular needs of this research (Plowright, 2011). The cases do not necessarily represent groups outside the research. They were chosen because the researcher believed the participants could contribute directly to the research questions. There are a number of non-probability sampling techniques and they are convenience sampling, purposive sampling, quota sampling and vital sampling (Plowright, 2011). For this research, convenience sampling is appropriate because the participants are conveniently located. Also, the researcher has a personal rapport with the respondents which made it easier for her to obtain consent for participation in the research.

For self-observation data researcher contacted 7 all-female universities in Saudi Arabia. These universities were selected to have wider representation and achieve generalisation.

- University should have a physical campus. Online universities were excluded
- University should be all female.
- University should be Saudi based. Foreign universities with a campus in Saudi Arabia were excluded.
- University should be among top seven universities in the kingdom by a number of students enrolled.

Out of the seven universities contacted three universities permitted the researcher to carry out research on their campus. The top seven all-female Saudi universities (by a number of students enrolled) were selected. Larger universities were selected to increase the target sample size. The only exclusion criterion used were: Researcher contacted all the academics from the three universities inviting them to participate in the research. Out of those 64 academics (21 from the first university, 17 from second and 26 for the third university) attended the first debriefing sessions. The researcher sent an invitation to all the attendees for installing the app to participate in the research. However, only 37 academics profiles were created which indicates that out of the 64 attendees 37 agreed to participate in the research.

3.6 Research Design

The concept or structure of a research design is defined by Burns and Bush (2004: 120) as "a set of advanced decisions that makes up the master plan specifying the methods and procedures for collecting and analysing the needed information". It focuses on research methodology, approach, data collection methods and the subsequent data analysis (Roberts-Holes, 2011). It also provides a framework for the collection of the data. The research design is a reflection of the research questions in order to provide a complete gathering of data that will allow the researcher to answer the research questions. The design for this research is the FraIM: Frameworks for an Integrated Methodology which was developed by David Plowright (2011). Below is the structure/framework for this research.

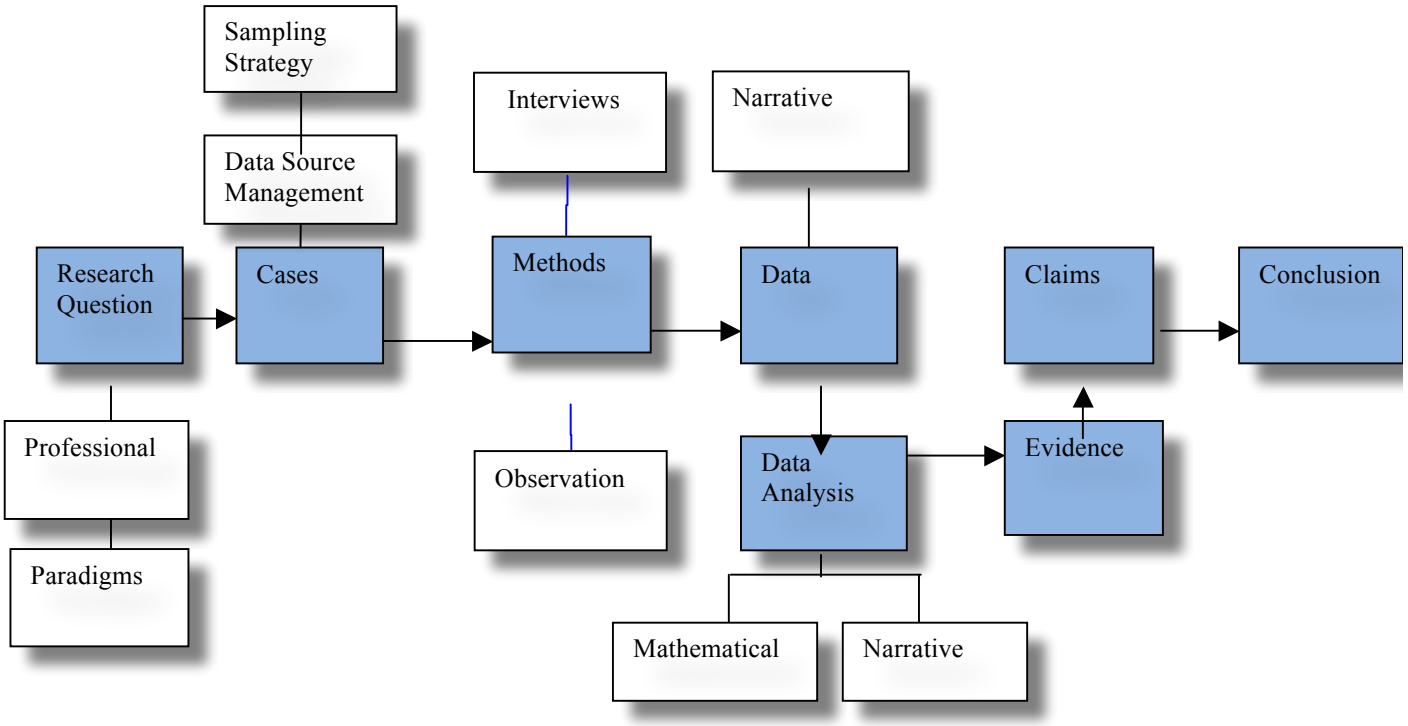


Figure 11: The FraIM structure for this research

3.6.1 The FraIM (Frameworks for an Integrated Methodology)

The FraIM is designed to help researchers carry out small scale empirical investigations of educational and social issues (Plowright, 2011). It is also designed to enable the researcher to understand the decisions made about the research and the actions taken when the research is carried out. The aim of the framework for this research is to support the integration of different elements of the research process to ensure that the workplaces are designed to boost productivity among workers. Integration in this research means to combine and structure quantitative and qualitative approaches coherently and logically. The starting point of the FraIM is the research questions and encourages a pragmatic approach to research. This is followed by the discussion on the philosophical paradigms underpinning this research. It then discusses the Cases, Methods, Data, Evidence and Conclusion. Also, the FraIM rejects traditional dichotomy between qualitative methods and quantitative methods and not force a particular philosophy for a researcher, to begin with (Plowright, 2011). Instead, it encourages an accommodating viewpoint on answering the proposed research questions and finding a solution to an important issue.

3.6.2 Intervention

As discussed above, this research is making use of the mixed method approach. Structured observation and interviews were both used interchangeably in this study. This research began with the researcher installing a customised mobile app on their mobile phones. Respondents used this app to send comments to the researcher on their daily experiences of workplace design and how it affected their productivity. This allowed the respondents to provide comments in real time which is critical to understand interaction with workplace which occurs in real time. This app was active on mobile phone's of the participants for 15 days. The app was active only during work hours on working days to make sure that the respondents sent real time data. During this time period, the respondents had the option of interacting seamlessly with the researcher. After the 15 days, period researcher compiled all the data and conducted a preliminary analysis of the data. This involved identifying the key themes within the data and understanding what the data conveyed. The data from the app was quantified and statistically analysed. This also led to the formulation of questions for the designers. Semi-structured interviews were conducted with the designers to get their opinion on the matter including how cultural, professional and gender aspects could be considered during designing. Following the interviews data from the interviews was content analysed.

The next section is concerned with the methodological tools and the data collection in this research

3.6 Self-reported observation using mobile app

The first set of data collected was using self-reported observations using a mobile app. Observation can be defined as "the watching of behavioural patterns of people in certain situations to obtain information about the phenomenon of interest" (Johnson and Christensen, 2014: 236). As this study is a case study, it is pertinent that the observation should take place in the natural setting of the participants. Research conducted with the observation method can take place in a naturalistic setting such as classrooms and recreation area (Keenan and Evans, 2009). This research is a naturalistic observation because the research was conducted in the natural setting of the teachers' workplace

which is the university. Before going on to explore further how observation method was used to answer the research questions, the strengths and weaknesses of observation will be discussed briefly.

Observation enables the researcher to collect data in different ways depending on the goals of the study. Observations such as time sampling, checklist and video recording can be used (Kennan and Evans, 2009). However, observation does have its limitations. According to Keenan and Evans (2009), it can be difficult to make sure that all relevant criteria are met when employing naturalistic setting and that data may be subject to the influence of the observer and the instruments of the observation (videos and cameras). However, in this research, because the data was self-observed i.e. the respondents themselves reported their observations, the researcher bias was minimal.

Using the FraIM has enabled the researcher to have a wider perspective on carrying out observations. First of all, Plowright (2011) states that data collection in this framework can be characterised in two important criteria and they are: level of mediation and degree of structure. He puts forward that level of mediation means how a method of data collection can be distinguished from other methods while the degree of structure means if the method for data collection is more of less structured. For this research, observation methods have a low level of mediation because the researcher will always be closer in time and space to what is being researched.

Structured observations are designed to give a numerical, standardised data in order to improve the reliability of findings (Mukerji and Albon, 2011). Johnson and Christensen (2014) also define it as standardisation of observational procedures in order to obtain reliable research data. They state that standardisation involves the following: who is observed, what is observed when the observations are to take place, where the observations are to be carried out and how the observations are to be done.

Structured observation can involve observational sampling techniques. They are time sampling, event sampling and snapshot techniques. This study will be making use of event sampling which involves respondents providing observation data whenever they observe some aspect of workplace design that they believe affects their productivity. Furthermore, researchers conducting structured observations use schedules as a data collection instruments. Schedules are used to record the activities of a person or a group

of people (Shraman at al. 2007). They are schedules which specific observations concerning targeted people are made (Robert-Holmes, 2011).

In the FraIM, structured observation is also known as the high degree of structure because it makes use of a coding schedule. The researcher observes categories of behaviour that are encoded and has less choice over what is recorded during the data collection (Plowright, 2011). Less structured observation also known as the low degree of structure is a naturalistic approach to observing behaviour that is based on open coding and usually takes place in the participants' natural location (Plowright 2011). These kinds of observations are usually done in naturalistic situations where the researcher records being guided by the overall aim of the research and interesting things that they see at the time (Mukherji and Albon, 2011). Also, in using less structured observation there will be less predictability in the data collected because open coding is being used which gives the researcher more choice on how the data will be managed and analysed (Plowright, 2011). It involves observing all potentially relevant phenomena and taking extensive field notes without specifying in advance what is to be observed in other words it is done for expository purposes (Johnson and Christensen, 2014:238). Researchers record what they observe and believe is important in their field notes. It is very different from the checklist because here the researcher will describe extensively what is observed in the classroom and then compares what is observed with the data from the observation. This will help the researcher discover how workplace design affects day to day functioning of the female academicians and consequently their productivity.

For this research, an observation schedule making use of open coding was created using the conceptual framework. Unlike conventional observation research, in this research, the observations were self-reported by individuals who were being observed. This meant that the respondents were free to report whatever they felt could be relevant to this research. The researcher did inform them of the aim, objectives and purpose of the research but did not try to restrict them in what they can report. Instead, researcher filtered out irrelevant responses at the data analysis stage. This was to make sure decision to determine the relevance of data rested with the researcher and respondents could simply post the comments without worrying about its relevance.

Self-reporting eliminated any observation bias that observations conducted by researchers can induce. This was considered essential because the researcher believes that it is almost impossible for any external observers to observe the manner in which the

workplace design affects the productivity of teachers. This interaction is known only to the people who experience and thus need to be known from their viewpoint/perspective only.

While interviews could have been useful for obtaining detailed and in depth, the perspective of the respondents but this was considered less useful because of the comparatively poor quality of data. The researcher wanted to ensure that the respondents provided most accurate data and this could only be done in real time. It is very difficult for any individual to reflect back on their day to day experience, especially about how they had been feeling about their work and productivity at any point in time in past. Furthermore, this would be even more difficult for the respondents to recall and talk about all instances when they felt that workplace design affected their productivity. To overcome these issues researcher decided to use a novel method of data collection which allowed collection of self-reported data in real time. Such methods are useful in collecting high-quality data in real time especially when the data collected can only be known to the respondents making it impossible for any external entity to observe/ notice.

There was no specific schedule except for that the respondents could only report their perspectives on a working day and between work hours. App did not allow them to send any information during other times. This was to maximise the effectiveness of the data, in other words, to ensure that the respondents sent only real time data. This is so because researcher believes that people's interaction with workplace design and impact on their productivity especially in professions like teaching can only be noticed spontaneously. It is not possible for individuals to accurately reflect back on their experiences of interaction with workplace designs in past except some noticeable cases like accidents.

3.7 Self-observation using Mobile app

Self-observation data was collected from the individuals using a mobile app. This app was developed for both Apple iOS and Google Android platforms. Self-observation data could have been collected in several ways. For example, a researcher could have provided printed sheets with tables for responses in which the respondents could fill their responses and hand over to the researcher at the end of data collection process. However, the response rate would have been very low if the perceived amount of effort required to

submit the responses was high. It was thus essential to select some method or reporting self-observed data without much effort. It was also essential that respondents and researcher could communicate with each other in real time

Data from the teachers was collected using self-observation method using a mobile app. The mobile app was considered useful in this research because:

- Mobile phones have become an integral part of modern life. According to STATISTA (2013), Saudi Arabia ranked third in the world in terms of smartphone penetration with estimates that 72.8% of Saudi population owned a smartphone. This is only 1% lower than the top ranked UAE. The penetration of smartphone in Saudi Arabia has since risen meaning nearly 3/4th of the population owned a smartphone. This means that majority of the target respondents i.e. teachers are likely to have mobile phone's making it a useful data collection tool.

- The high proportion of mobile-based social media users in Saudi Arabia indicates that most Saudi Arabian individuals are proficient in the use of mobile phones in terms of using mobile apps. This means that the researcher could develop a non-invasive, targeted and simple app with limited functionality and use it for data collection without overly worrying about the ability of the respondents to use the app. In addition, the researcher provided detailed guidance on to use the app and was always available for the respondents to ask questions through a range of chat apps (Whatsapp/ Skype/ text messaging and email).

- Most individuals have 24/7 access to their mobile phone's and this means that sending information through mobile phone's will cause minimum discomfort to the respondents. The chart below shows the data collection through a mobile app.

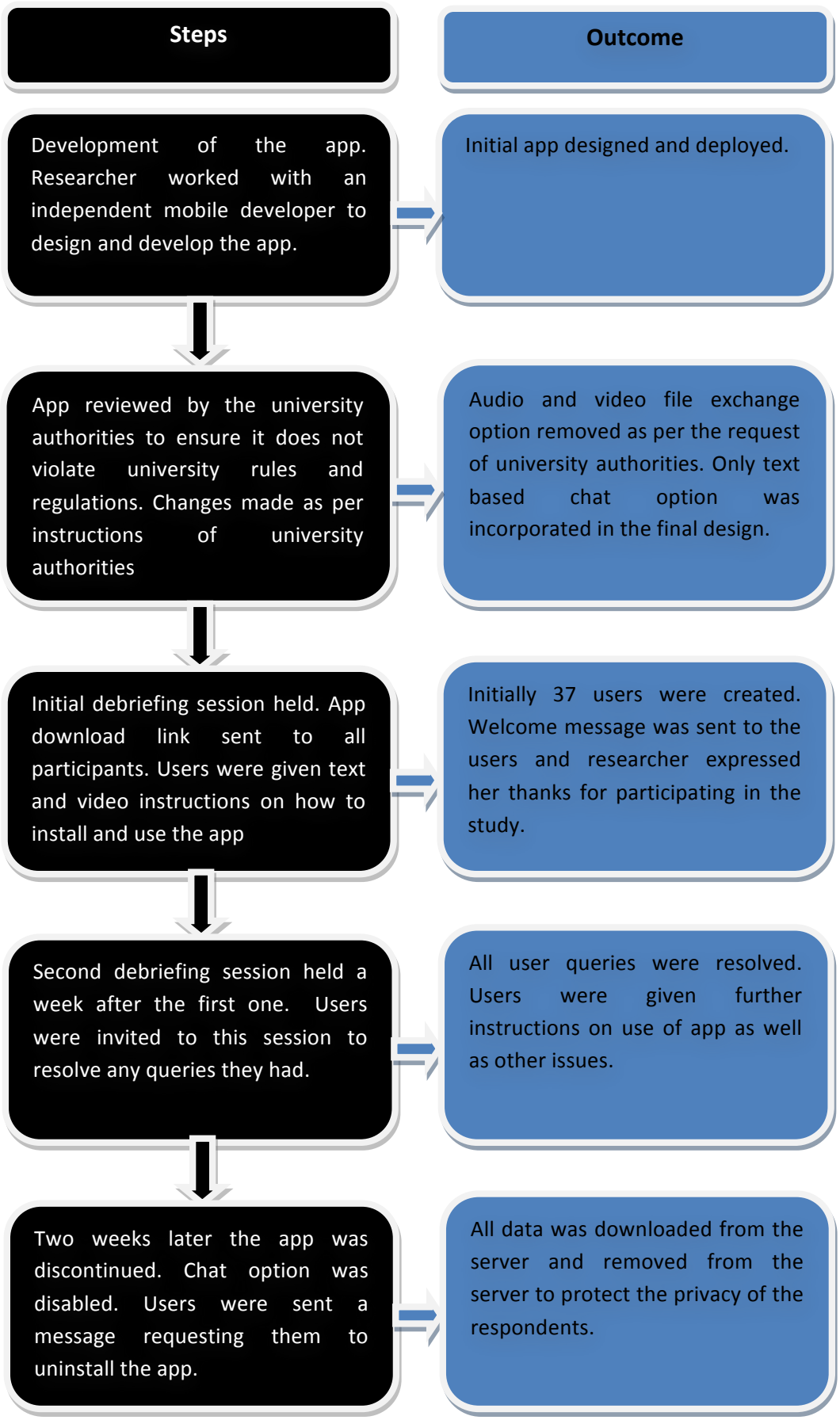


Figure 12: Steps in mobile app data collection

3.7.1 Development of the app

The researcher developed the mobile app with one UK based mobile app developer. Researcher provided the mobile app developer with complete details required for developing the app. App developer was provided with a brief of the project and theoretical framework. Following this, the researcher explained the specific purpose of the app and specified what kind of data will be collected by the respondents. In addition, the researcher discussed what should be the key attributes of the app. In total researcher had seven app planning meetings with the app developer followed by 4 review meetings whereby the app developer showed the developed app and researcher provided her comments on what further modifications were required.

Following were the specifics of the app

- This app could only be used for the respondents to contact the researcher. This means that this was different from simple chat applications because the respondents could not contact each other. They could also not see what communication the researcher was having with other respondents and even who the other respondents were. This was to maintain privacy and anonymity of the respondents.
- Respondents could create their own profile including any username they wish to choose. The researcher was not able to see their real names or phone numbers but only their username they chose for this chat application. They were advised to choose a completely different name from their real name to ensure that they were not identifiable even to the researcher.
- To make sure that the respondents sent comments about their real life experiences of workplace designs only, the app was designed to work only on working days and between hours of 8 AM to 5 PM which are the working hours in Saudi Universities.

The following figure depicts the key issues faced during data collection through a mobile app and the solutions used:

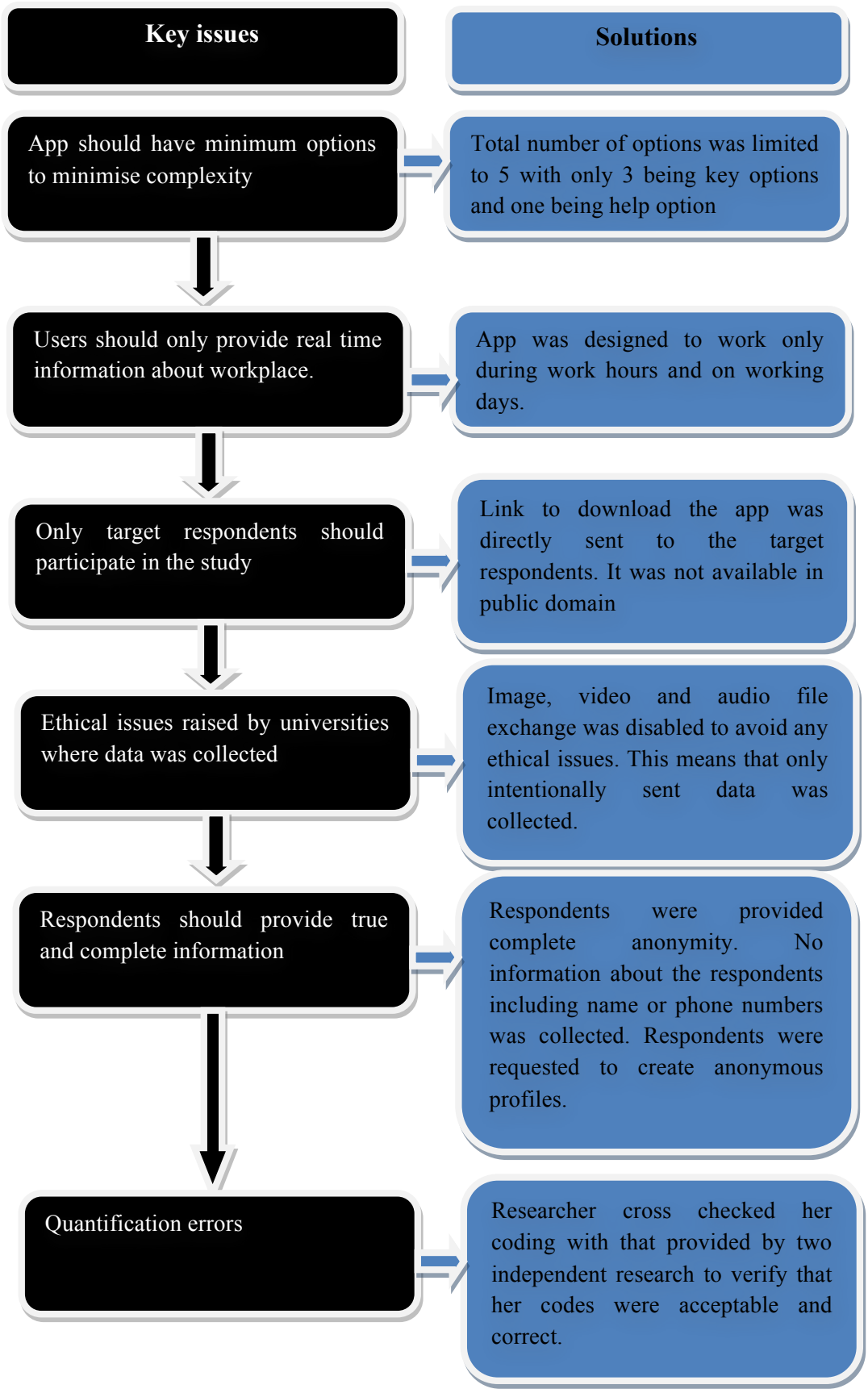


Figure 13: Key issues faced during data collection through mobile app and their solutions

3.7.2 App functioning

The chat was named “Nouf Brunel PhD Project”. The app was designed to begin with an information screen as shown below:

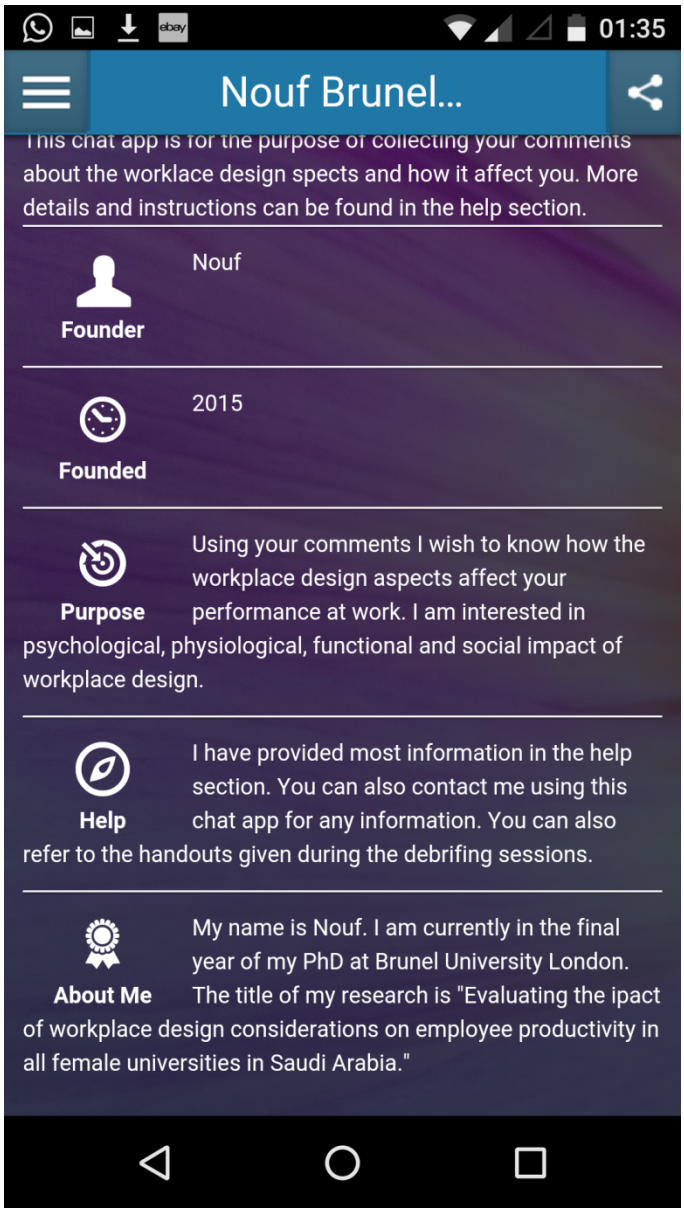


Figure 14: Screenshot of the main screen in the Mobile app

This screen contained some short information about what this app was supposed to do. There was an additional help section where more detailed information about the app including its purpose, how it works and how to use it was presented. Respondents can visit that section anytime to get answers to most basic questions. Respondents could click

on the menu section above the info screen to browse through to the menu. Following screen was designed to appear when the respondents clicked on the menu:

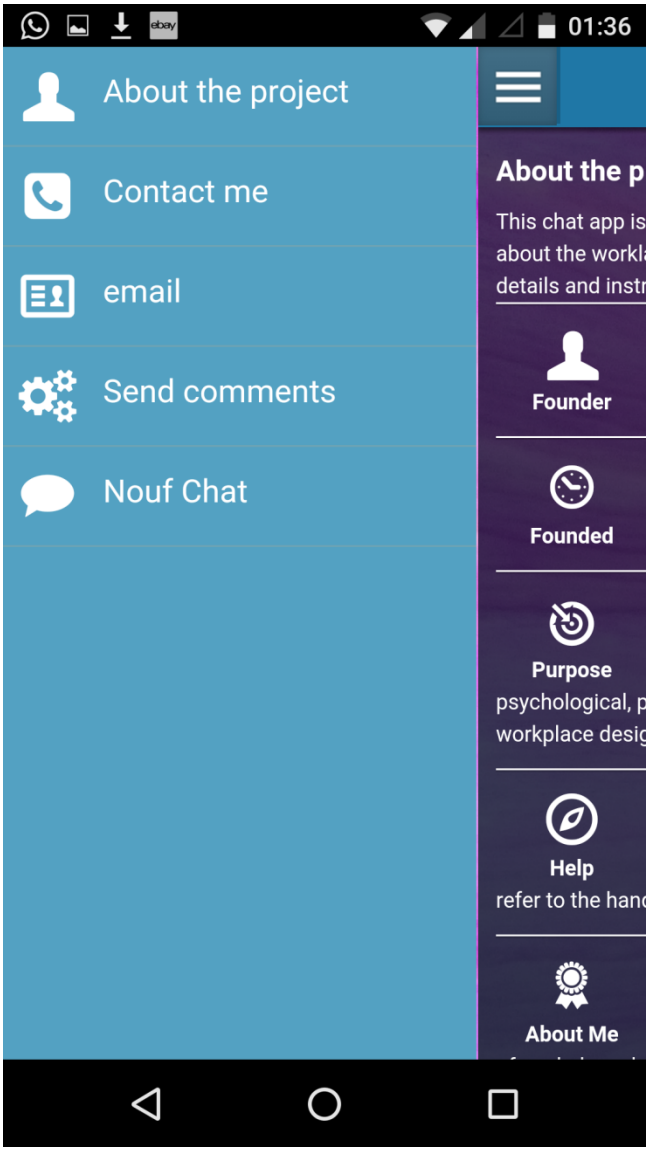


Figure 15: Screenshot of the menu screen in mobile app

They could visit “About the project” section to view the details of the research project, what is its purpose, aim and objectives and what the researcher is trying to find. This was useful for them to understand what kind of information may be relevant for the research.

Contact me as a link which contained details of researcher’s contact details including her email address and phone numbers.

Email option allowed the respondent to email the researcher directly.

Send comments link allowed the respondents to provide comments using workplace design. This was the key link where the respondents could provide all their responses regarding the research.

Nouf Chat option was used to have a direct chat with the researcher. Respondents could use this link to chat with the researcher regarding any aspects of the research such as providing suggestions and raising concerns.

Contact me option presented the contact details of the researcher for the respondents to use for resolving any queries.

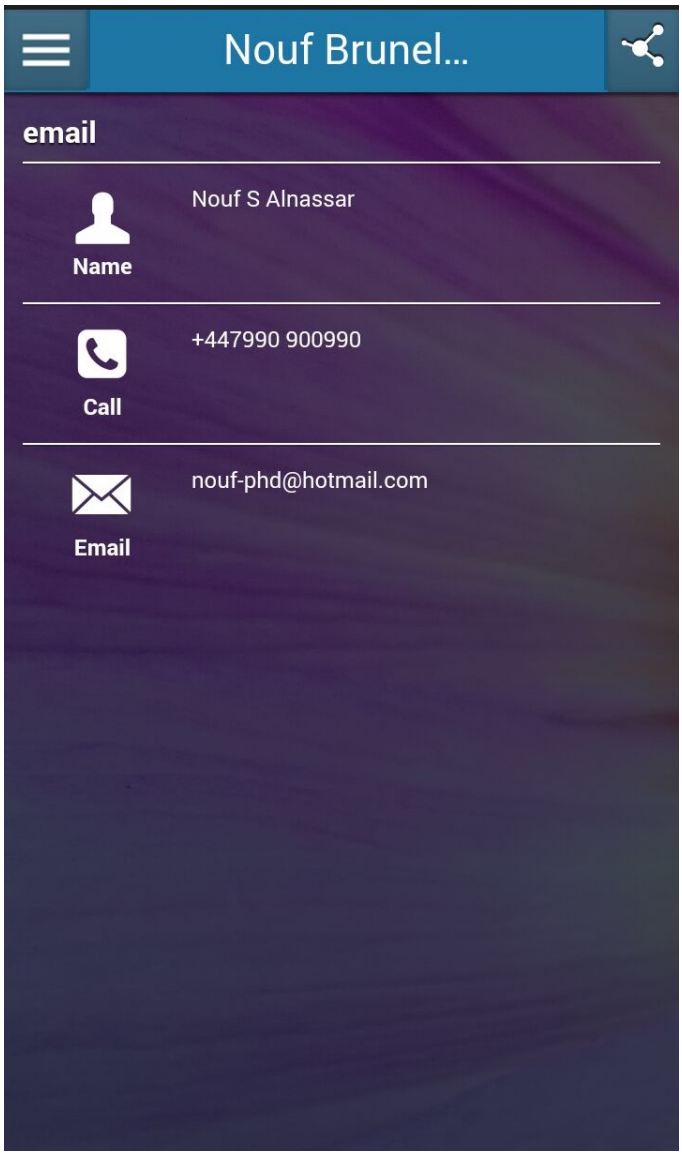


Figure 16: Contact me page on the mobile app

Figure 17: Screenshot of the main chat screen windows for sending comments

The figure above shows one of the comments posted by the respondents. Every time respondents sent a comment using the "send comments" link they were asked to answer two more questions.

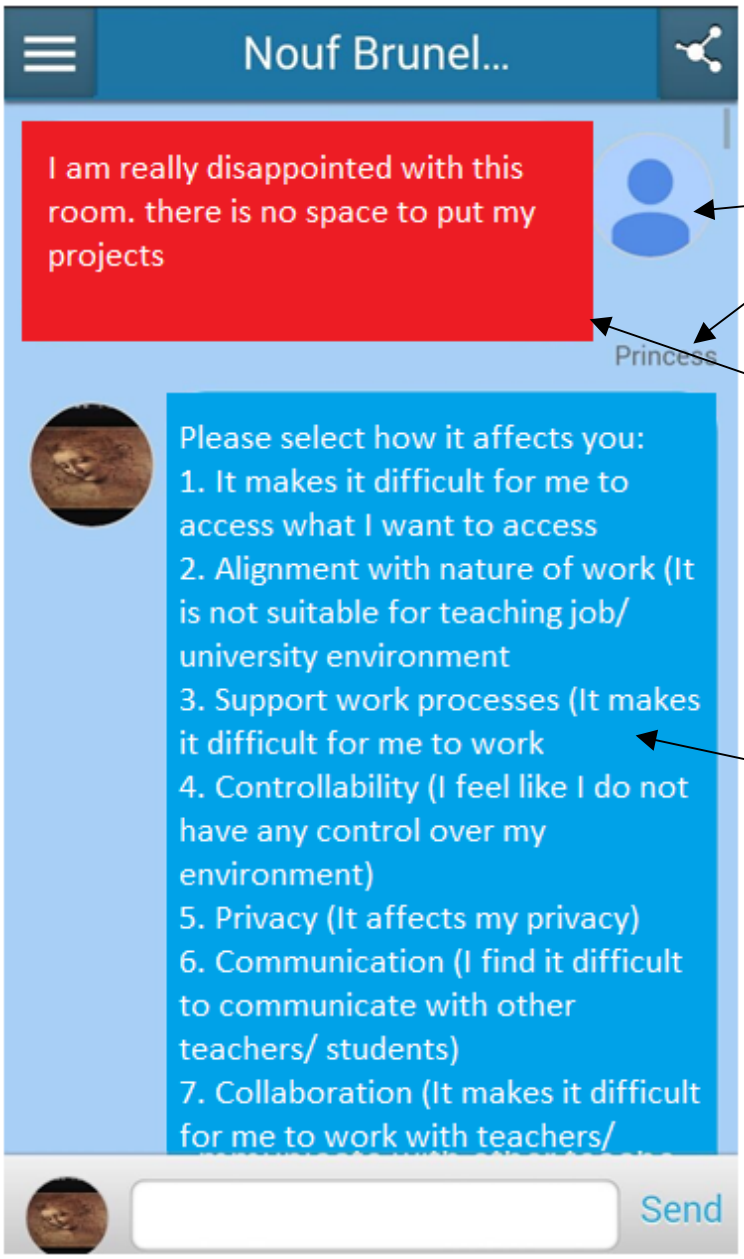


Figure 18: Screenshot of the main chat screen windows for sending comments

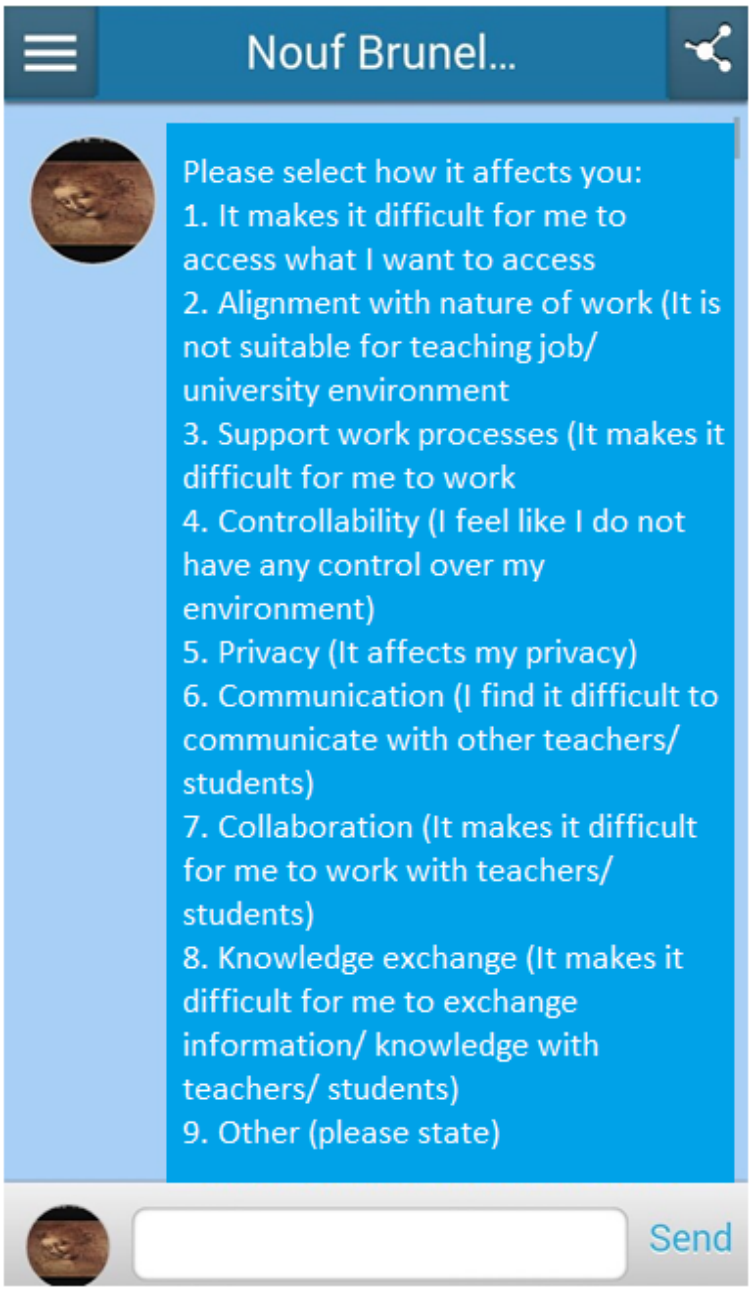


Figure 19: Screenshot of the main chat screen windows for sending comments

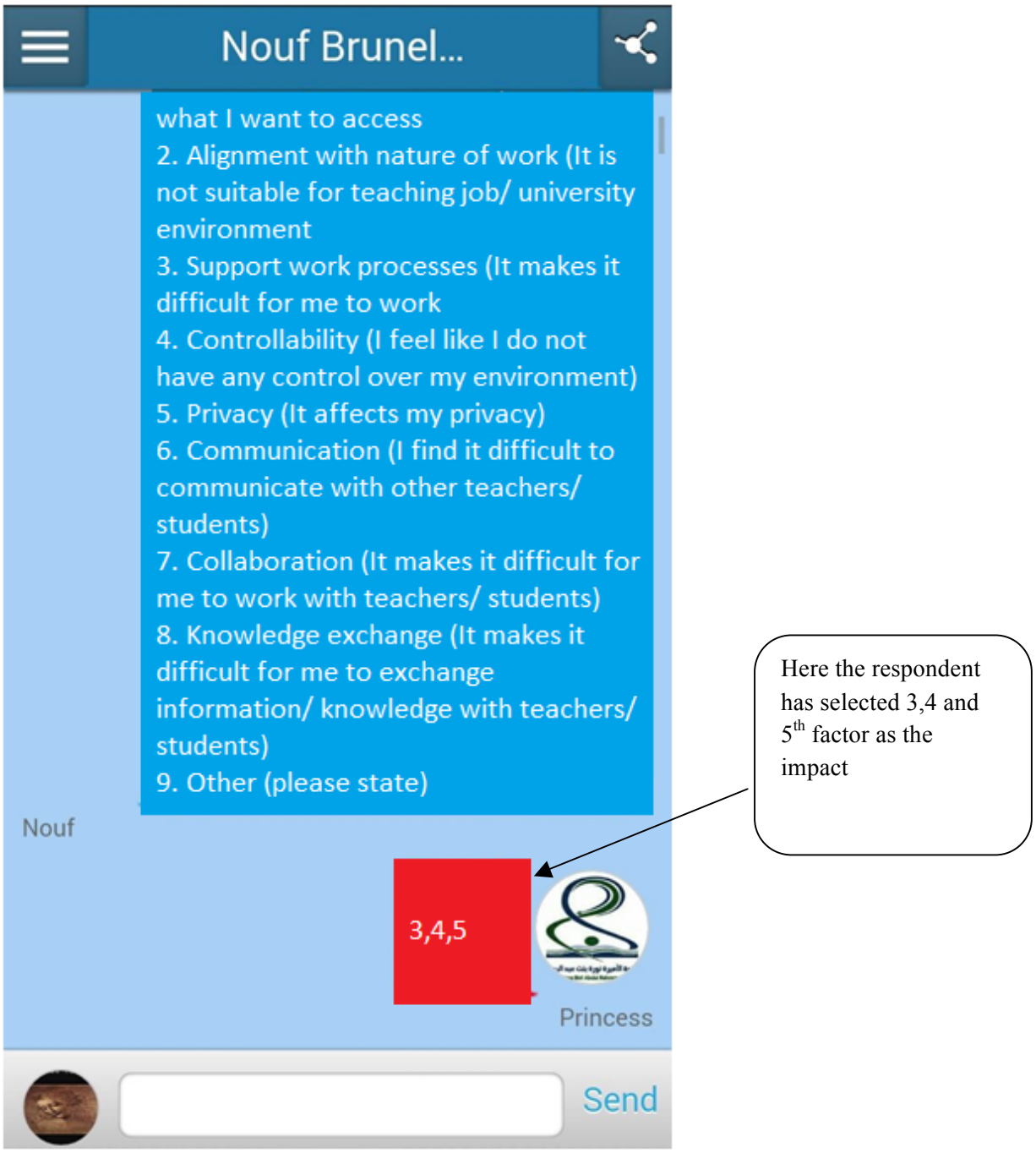


Figure 20: Screenshot of the main chat screen windows for sending comments

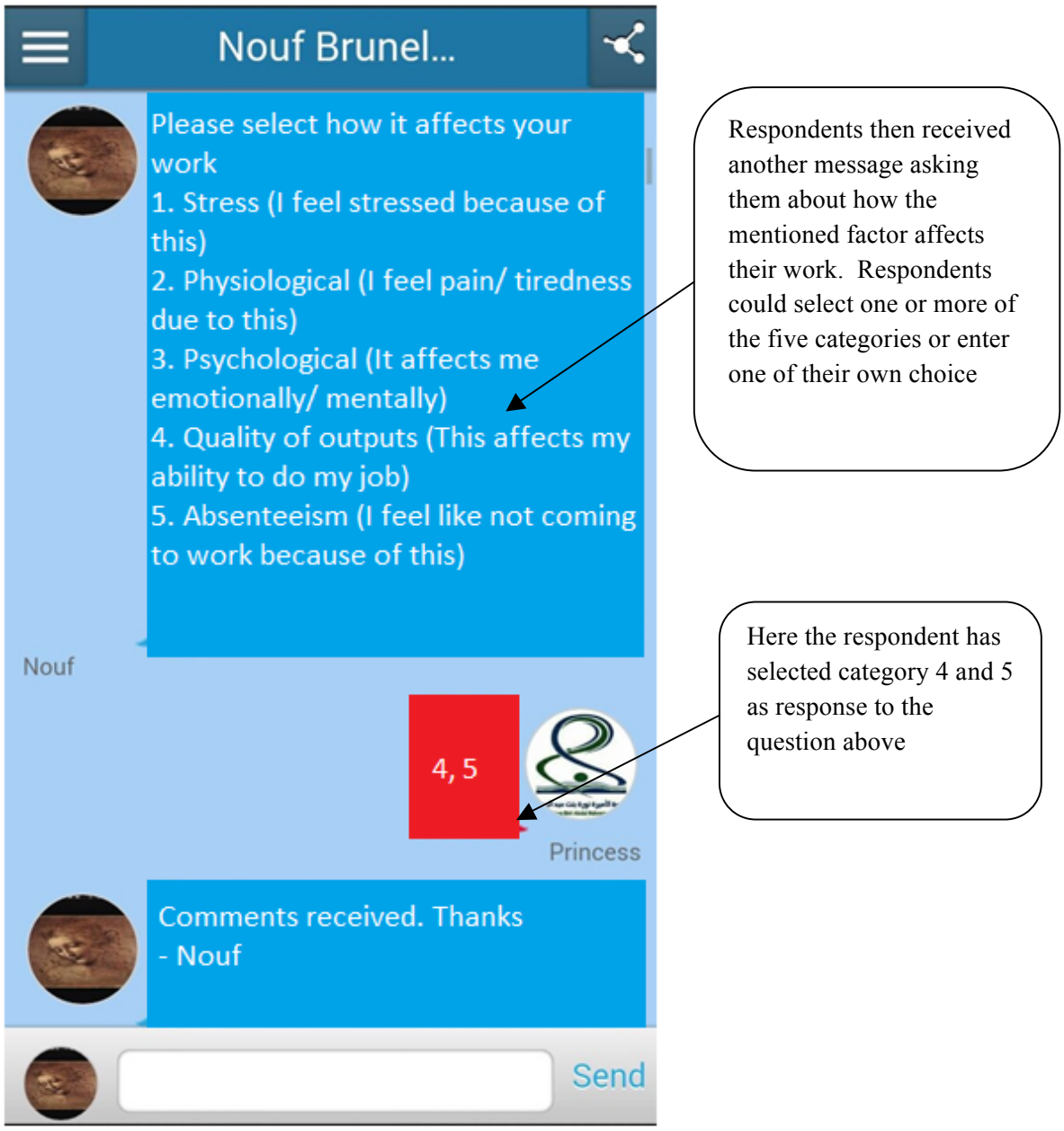
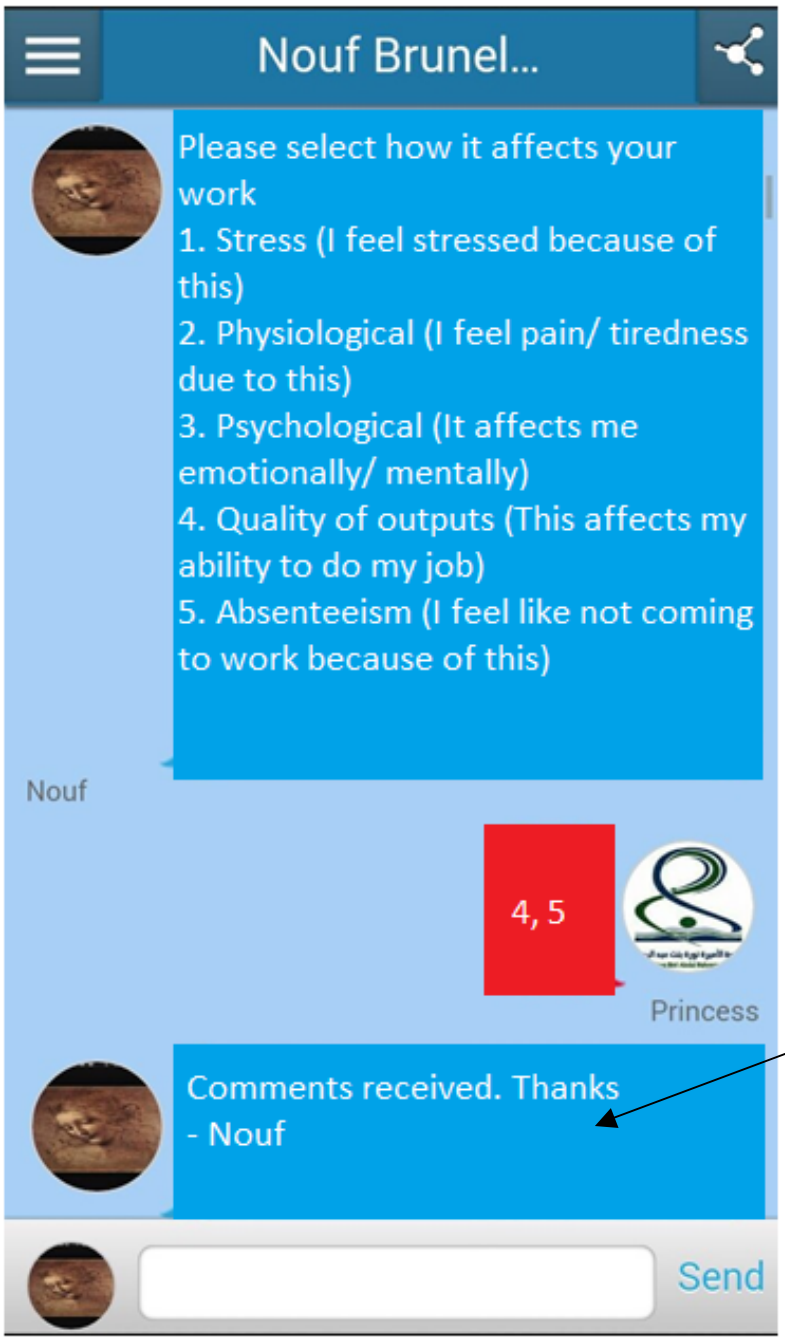


Figure 21: Screenshot of the main chat screen windows for sending comments



Respondent was then sent a thank you message which completed the whole response process. Thus every response process had a beginning with the respondent sending a message about workplace design and end with this thanks response.

Figure 22: Screenshot of the main chat screen windows for sending comments

All the data was stored on Firebase app dashboard. Given below is a snapshot of the database windows:

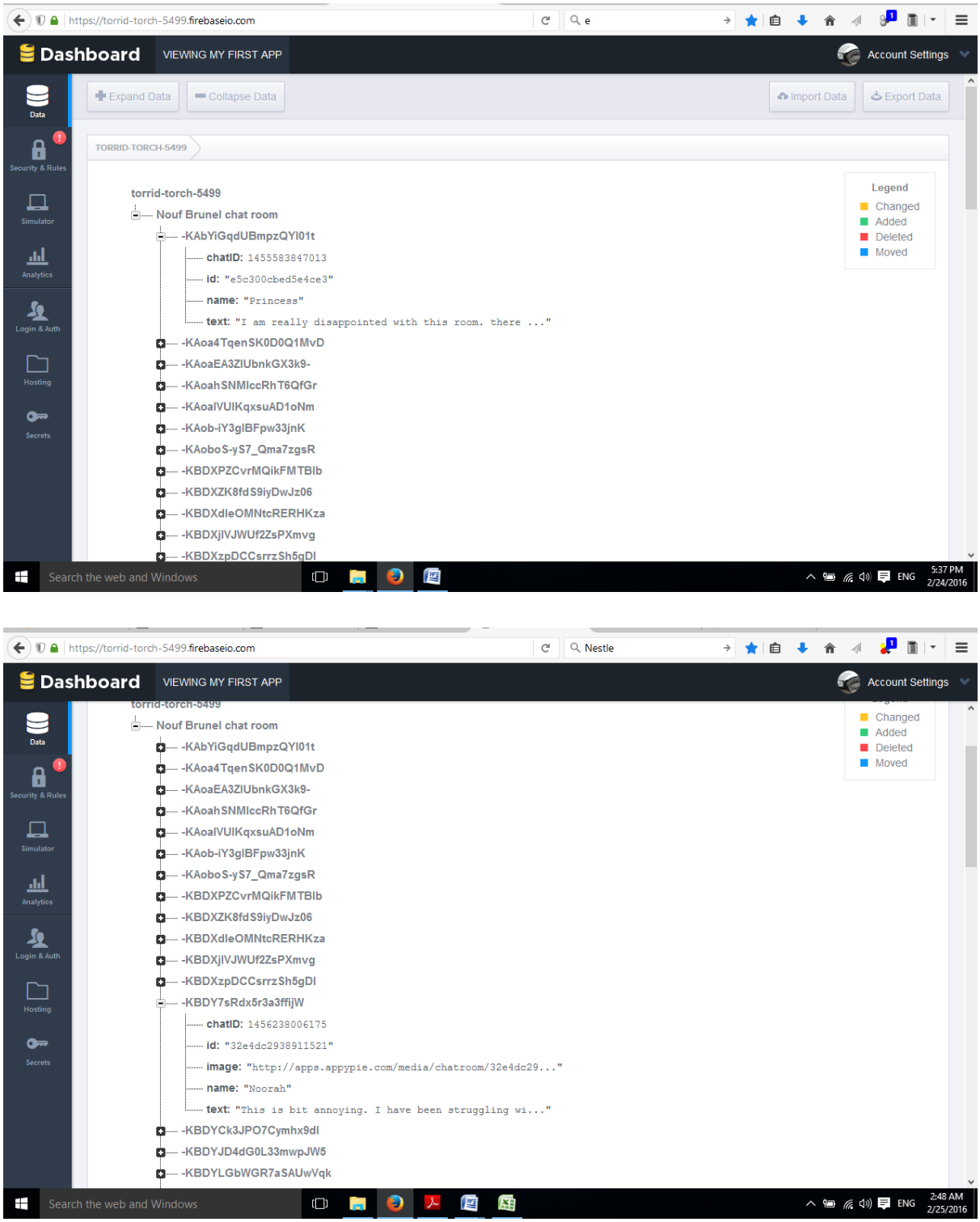


Figure 23: Snapshot of the server view where the comments were downloaded from the server and stored adequately

The app functioned so that:

- It worked only during working hours and on working days.
- It was live for 3 weeks period. It automatically stopped working after 21 days and respondents were sent a message to uninstall the app.
- Once a respondent sent a comment, the app started a session for the respondent. This session was used to cluster together the responses from the particular respondent.
- Respondent created own profiles to ensure anonymity. The researcher did not know about the identity of any of the respondents. Respondents were asked to select profile name and images which will make it difficult to recognise them. The phone numbers of the respondents were not visible to the researcher assuring complete anonymity.

3.7.3 App deployment and use

After getting approval from the concerned institutions, the researcher contacted the respondents directly. Respondents were contacted through email and a consent form and detailed information sheet were sent along with the email. Respondents were asked to send their consent in written form or through email if they are willing to participate in the study. Respondents were told that the research will involve installing an app on their smartphone and they will be able to send comments to the researcher about their workplace and how it could be improved to boost their productivity. Owning a smartphone was one of the criteria that all participants had to fulfil because data for this research was to be collected through app only.

The process began with the researcher inviting the intended participants to an information session. Five different sessions were held on five different days between 20th and 29th June 2015. Two sessions each were held in two universities while only one session was held in the third university. The reason for more than one session was to ensure maximum participation as not all intended participants were available on the day of the first session.

Each session began with the researcher introducing her self and then proceeding on to providing information on her research. She discussed the purpose of her research and

informed them of what specifically she is looking to investigate. The researcher explained the functioning of the app including when and how to use it. She gave a detailed video presentation to the respondents. More information of this was also included in the help section. For more help respondents were told to contact the researcher directly using the contact option in the app. Following this, the researcher conducted a Q&A session for participants to ask any questions or concerns they have. Once the Q&A session as over, the researcher asked which of the participants still wanted to go ahead with participation in the study. The researcher explaine to the respondents that even if they wish to withdraw their participation at any stage of the project they simply need to uninstall the app from their phone. However, this will only remove their future comments but any comments they have had already sent through the app will remain in the database and can only be deleted if the respondents explicitly request for those to be removed.

The researcher asked all of the respondents for their phone numbers and the operating system i.e. whether they owned Apple iPhone or an android phone. Following this, the researcher sent the installation file to each one of the participant's phone. For this NoufProject.IPA file was sent to devices running Apple iOS and NoufProject.APK file was sent on devices running Google's Android operating system. The researcher explained how to install and use the app. Those who did not wish to participate in the research were simply asked to delete the message and they need not do anything. Those who wanted to participate could do it anonymously. Researcher provided them with written instruction on how to do this and how to create a profile including how to protect their privacy by selecting random profile name and images.

In the every time, a respondent sent a comment a new session was created. This session ended when the respondent had answered all the three questions. If for some reason the respondents did not answer the three questions, she will be asked whether she wants to complete previous response when she checks the app next time. She then will have the option to complete the previous session or to delete it and start new.

For privacy and ethical purposes, audio, video and image sharing was disabled on the app. Respondents were allowed to send only text messages. This was also to ensure that the authorities will give permission for the data collection because photographing women for public publications like an academic research is prohibited in Shariah.

Some of the images of app are given in Appendix 2

3.7.4 App Data analysis

The data from the mobile app was collected in mixed format (qualitative+ quantitative). Each response comprised of three parts; the first part contained a comment in qualitative format and the remaining two parts were quantitative. However, the data was analysed quantitatively and for this purpose, data was quantified. In qualitative research data analysis often involves categorising data according to the themes and then analysing a set of respondents under each theme. Quantification in this research was considered essential for several reasons.

- There were a large number of comments and there was a possibility that qualitative analysis of such a large number of comments could have been messy and could have led to confusion. Even worse there was a possibility of researcher bias in which the researcher could select only those comments which confirmed her belief. To avoid such issues from affecting the quality of findings it was considered both essential and useful to quantify the data. Using objective and neutral coding technique helped the researcher to minimise her personal bias during data analysis. This also meant that the researcher was able to select all relevant comments rather that basing her opinion on selected few.
- Qualitative data analysis lacks credibility in testing relationships. This research was not simply an exploration of consideration of cultural, gender and professional factors in design considerations but it went beyond that and looked at whether these considerations will lead to any meaningful gains in employee and/or organisational outcomes. For this, it was essential to test the relationship between these variables and this was only possible through quantitative methodology.

3.7.5 Quantification of qualitative data

The first step was that the respondent sent her comments about something she observes or experiences at the workplace. This is to be linked to the first category i.e. design considerations. This was done manually when all the data was collected. So the user comments were linked to one of the subcategories in the "design considerations" category. After the user had posted the comment she will be asked to the subcategories in the "quality of workplace design categories". This has eight categories:

F1: Accessibility (It makes it difficult for me to access what I want to access)

F2: Alignment with nature of work (It is not suitable for teaching job/ university environment)

F3: Support work processes (It makes it difficult for me to work)

P1: Controllability (I feel like I do not have any control over my environment)

P2: Privacy (It affects my privacy)

S1: Communication (I find it difficult to communicate with other teachers/ students)

S2: Collaboration (It makes it difficult for me to work with teachers/ students)

S3: Knowledge exchange (It makes it difficult for me to exchange information/ knowledge with teachers/ students)

Other (please state)

So the user had to select which of these categories does the factor effects. Once the respondent had selected one of these categories they were asked to select one of the outcomes:

EO1: Stress (I feel stressed because of this)

EO2: Physiological (I feel pain/ tiredness due to this)

EO3: Psychological (It affects me emotionally/ mentally)

OO1: Quality of outputs (This affects my ability to do my job)

OO2: Absenteeism (I feel like not coming to work because of this)

Other (please state)

Once all the responses were received these were manually coded. Every response consisted of three parts; the first part referred to Design considerations, while the second one referred to Quality of workplace design and third part referred to impact on productivity.

Each response was analysed individually. The first part of the responses was thematically analysed to see the existence of the themes from "design considerations."

Design considerations	Quality of workplace design	Productivity
C1: Power distance	F1: Accessibility	EO1: Stress
C2: Masculinity	F2: Alignment of nature of work	EO2: Psychological
C3: Individualism	F3: Support work processes	EO3: Physiological
C4: Uncertainty avoidance	P1: Controllability	OO1: Quality of output
C5: Indulgence	P2: Privacy	OO2: Absenteeism
C6: Long termism	S1: Communication	Other
P1: Work processes	S2: Collaboration	
P2: Facilities	S3: Knowledge exchange	
P3: Nature of work	Other	
P4: Layout		
G1: gender issues		
G2: Gender needs		
Other		

Table 7: Themes for quantification of app data

The relevant cells were marked as one and the other cells were marked as 0 for each and every response.

This is how the final dataset will look like:

Design considerations												Quality of workplace design								Productivity				
C1	C2	C3	C4	C5	C6	P1	P2	P3	P4	G1	G2	F1	F2	F3	P1	P2	S1	S2	S3	EO1	EO2	EO3	OO1	OO2
1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0

Table 8: Sample quantification strategy used to code app data

The table below gives a sample of how coding was done.

Design considerations	Quality of workplace design	Productivity
This is a bit annoying. I have been struggling with this table the whole day. Just not enough space for me to work.	9 I would prefer to have a table which I can move. Not fixed	1,2
Extremely bright lights are very distressing	2,4	1,2,3,4
I would prefer soft colours in my room	9 If affects my mood and also my ability to work	1,3
There is no nice place to sit and have coffee. We need a nice cafe.	9 I need some place to relax	5
We should have some natural open space inside the building	9 the building looks like concrete and glass	1
Very poor furniture design. It has sharp edges.	1,2,4	1,4
Is it safe to have wires cluttered on the floor like this	1,2,3	1,3
I have hurt myself three times today with this table	1,3	2
There is too much noise from the corridor when people walk past	5, 9 I find it difficult to focus on my work	1,3,4

Table 9: Example of coding

3.7 Validity and Reliability

Mixed methods are seen to be the preferred approach to collecting rich data however, there are some barriers to mixing methods in a research. Firstly, it is wondered how far mixed methods researchers analyse and interpret their research in a way that both qualitative and quantitative parts are complementing (Bryman, 2007). If not organised

carefully the results obtained can become subject to question (Bazeley, 2002). This is why it is argued that a researcher before embarking on a mixed methods research should have a deep understanding of quantitative and qualitative approaches and the different paradigms and methods that underpin them so as to avoid mistakes and most importantly corruption of results collected.

3.7.1 Validity

There are also validity issues with mixed methods research (Creswell and Plano-Clark, 2007). Mixed methods writers have written about validity in mixed methods research (Onwuegbuzie and Johnson, 2006; Tashakkori and Teddlie, 2006). It has been argued that researchers should be cautious about mixing methods because it can threaten the validity of the claims because traditional methodological assumptions are likely to be violated during the mixing (Morse, 2003). Both qualitative and quantitative research has validity issues but these differ in qualitative and quantitative approaches. Validity is basically referring to correctness and truthfulness on the quality of data (Johnson and Christensen, 2014).

According to Creswell (2004), validity issues in mixed methods research can be addressed in the following ways: validity should be discussed within the context of both quantitative and qualitative research in the study because researchers collect, analyse and interpret both forms of data, traditional approaches to validity should not be minimised. In quantitative research, validity means that the researcher can obtain meaningful inferences from the results to a population; reliability means that the scores received from the participants are consistent over time (Creswell and Plano-Clark, 2007). This research included quantification of qualitative data and there was a strong possibility that the researcher made mistakes in the quantification of the qualitative data. Basically, the approach used to quantify the qualitative data was similar to what many researchers use while using quantitative analysis of qualitative data. Researcher verified her coding strategy with two independent PhD researchers from the similar subject area. The independent researchers were debriefed about different aspects of the research including the conceptual framework. They were then requested to code some of the comments on their own and the coding obtained from the independent researchers was then compared with the coding done by the researcher.

In qualitative research, validity means that the results provided by the researcher and the participants is credible and can be trusted (Lincoln and Guba, 1985).

One threat that affects validity is researcher bias. This issue is frequently an issue in qualitative research because it is less structured and open-ended than quantitative research (Johnson and Christensen, 2014). However, with the quantitative method which prevents researcher bias, the strength of the quantitative method in this research supports the weakness of qualitative research. The results from the quantitative research if similar to the qualitative can improve its validity and reliability. Also, as this research is a mixed methods research, making use of qualitative approach puts it in danger of being affected by researcher bias. Providentially, a key approach used to limit researcher bias is reflexivity. This means that the researchers critically reflects on his or her bias thereby becoming more aware and monitor their biases (Johnson and Christensen, 2014).

With this said, mixed method research should not be regarded as a "magical methodological solution for the complexities of social inquiry" (Greene and Hall; 2010: 131). Instead, this research will not take mixed methods research and pragmatism uncritically and blindly. From the above discussion, the researcher attempted to understand thoroughly what it entails to conduct a mixed study research with its pragmatism as its philosophy.

3.7.2 Reliability

One of the key concerns in this part of the research was the reliability of data. Reliability refers to whether the views of the respondents will remain consistent over time. In this research, the aim was to learn about day-to-day experiences of individuals. Since individuals experiences do not stay the same over time it cannot be expected that the responses to the questions will remain same. However, this research was not about asking questions but about learning from people's experiences. So respondents were motivated to share their life experiences with workplace design. The researcher does not expect the respondents to share the same experience every day. But by collecting data over a long time period of 15 days researcher tried to eliminate any time related bias in respondents' views. For example, people can be more complaining if they were facing some other personal issue while they may report positive views when they feel positive about other

personal things in life. Collecting data over 15 days period helped the researcher in eliminating such bias from her dat

3.8 Semi-structured interviews

3.8.1 Usefulness of interviews

In addition to collecting data from the teachers, this research also included data from the designers who have been involved in projects of designing all-female Saudi universities in past. Interviews are quite useful in this research because designers are professionals who possess unique insight into their decision making. Since the researcher is unknown to this decision process it was not possible to adopt a structured approach to obtaining this information. Instead, a direct, face to face approach in which the author can obtain the insight through an in-depth discussion with the experts was considered more suitable for this research. Semi-structured interviews were useful because this research uncovers some aspects of workplace designing which have not been discussed in sufficient detail in past research. As such even the respondents may lack explicit knowledge of the use of these aspects in workplace designing. Using a direct and face to face interaction the researcher can provide more clues to the respondents on what kind of information she is seeking and this would allow the respondents to provide more accurate responses. In indirect data collection processes, respondents may give inaccurate responses due to inaccurate interpretation of the question. The vast scope and nature of the topic discussed under this research also make it difficult to use a structured approach especially considering the small sample size.

Interviews are generally the most appropriate data collection tool when the sample size is quite small and when the sample comprises of experts. In this research qualitative data was collected from a handful of experts who have worked on projects involving designing of all-female universities in Saudi Arabia. There are very few such universities in Saudi and consequently fewer designers who have worked on designing these universities. The sample size was further reduced because many of the designers who have worked on these universities were either not available for interviews or were completely inaccessible for the researcher. Thus, the sample size of experts for this

particular research as quite small and interviews were found to be the most suitable strategy to collect useful data from this small set of respondents.

The key benefits of using interviews for this research are as follows:

- It allowed the researcher to collect quite useful and insightful data despite having a very small set of respondents.
- It allowed the researcher to engage in one to one discussion with experts which allowed them to provide information as required. This allowed the researcher to explore new options trough engaging a constructive discussion. Some of the aspects which were not known to the researcher were also explored in the interviews.
- Respondents are senior professionals. It is quite difficult to arrange a focus group with such senior professionals because getting all of them to take out time together to attend a focus group is difficult. Interviews allowed the researcher to collect data from the respondents at their own convenient time and location.

Several researchers have used interviews for data collection in workplace design research (Lahtinen et al. 2015; Nickpour, 2012; Smith, 2007; Zagreus et al. 2004). For this research, it was essential for the researcher to use an active interviewing technique. Active interviewing goes beyond a simple question and answer session to an active discussion between the participant and the researcher so that new and rich information can be actively assembled or created. In this method, the interviewer attempts to activate interviewee's "stock of knowledge to convey situated experiential realities in terms that are locally comprehensible" (Holstein and Gubrium, 1997: 123).

Interviews comprised of four stages: preparation of interview questions, a collection of data, analysing data and interpreting data (Onwuegbuzie et al., 2009).

3.8.2 Questions formation

The interview questions were designed to be more open in nature to elicit a more holistic discussion on respondents' experiences. Since the three design considerations that this research looked at i.e. culture, gender and profession and not explicitly considered it was

essential to get a broader set of information and look for clues on how designers could have been considering these aspects.

Forming interview questions was a difficult aspect. The researcher used the information gained through the literature review as well as through open-ended self-observation of the teachers working in all-female Saudi universities to form the list of questions for the interviews. It was essential for the researcher to be selective about the questions because otherwise, the session can turn into a long meaningless discussion. Researcher prepared one question for each of the variables and let the respondents provide detailed information. However, researcher adopted a sequential process for preparing a question. This means that knowledge gained from all previous interviews was used to form questions for next interview. This ensured that the researcher gained more knowledge as she proceeded with interviews. These interviews were semi-structured which means although researcher had some questions at the beginning but she also asked additional questions during the interviews depending on the discussion in order to seek additional information and clarity.

Respondents had the choice of responding in English or Arabic because the researcher is bilingual. The researcher wanted to make sure that the respondent did not feel restricted in expressing themselves due to language issues.

The researcher contacted the respondents through their employing organisation. Detailed information about the project, its aim and objectives, nature of the information sought etc. was exchanged with HR manager of the employer of the target respondents. A sample of the kind of questions asked was also provided. This was to alleviate any fear that the authorities could have had about what kind of information will be collected and how it will be used.

All required and requested information was provided and written consent was obtained from the HR manager to directly contact the participants. After this, the respondents were directly contacted. It was clarified that relevant permission from the HR division had already been obtained but that the participants were under no obligation to participate in the research. Participants were told that their participation is voluntary and that they will have the option to opt out at any stage of the project without any conditions.

3.8.3 Data Collection

Interviews began with the researcher formally introducing herself and a brief discussion on the objectives of the research. The researcher also briefly told the respondents of key and interesting findings from the self-observation part of data collection. The researcher also sought the permission of the respondents to audio record the interviews. These recordings were only meant to prepare the interview transcripts and were destroyed after preparation of transcripts. During the interview, the researcher asked questions and listened patiently for the respondents to provide information. When more information was required or when the researcher had to seek more clarification then the researcher asked some follow-up questions. The researcher also requested respondents to provide as many as possible real life examples from their past experience.

3.8.4 Data analysis

In this research, a total of 11 interviews were conducted with designers who have worked on projects involving designing of all-female universities in Saudi Arabia. In total 9 interviewees gave their permission to record the interviews and for remaining two respondents who did not agree with having their voice recorded, the researcher took down notes. The total length of audio recording obtained was 543 minutes. Researcher transcribed the audio recordings and recreated the interviews based on notes taken. These transcripts were hen compiled and analysed. From each and every interview transcript key themes were identified. Information was distributed under different themes. The existing set of themes was used to classify the information and information which could not be categorised under any theme was put separately. New themes were identified and framework was developed on basis of new themes.

3.8.5 Data interpretation

Interpretation of qualitative data is one of the most significant aspects of qualitative research (Clark and Creswell, 2011). If the researcher fails to interpret qualitative data correctly it could lead to inaccurate findings. It is, therefore, essential to seek as much clarification as possible to make sure that he/she is understanding the respondents'

opinion as intended by the respondent. In this research also researcher used the probing technique to probe the responses. In addition, the researcher asked respondents to provide real life practical examples to elicit their responses. This not only allowed the researcher to collect meaningful data it also ensured that the respondents could give verifiable responses which they could self-verify through practical examples in their life. In certain cases our beliefs could differ from our experiences even though our experiences are facts. It is thus more useful to trust our experiences than mere beliefs. Using self-reflection through practical examples help ensure that people provide information based on facts and not mere beliefs.

In interpretation researcher used the knowledge gained through the literature review during her interaction with the respondents to identify possible new themes for analysis.

3.8.6 Limitations of interviews

While interviews have been widely used in research on workplace designing but it has certain limitations which must be taken into consideration when interpreting interview data. Firstly, there is a strong likelihood that some of the respondents, due to fear of some repercussions and lack of anonymity will provide incomplete or inaccurate information. To overcome this problem, researcher assured respondents that their or their employer's name will not be recorded and will not be used in the research. Hence for any third party, it will be almost impossible to identify the respondent or their employer.

No two individuals are the same and there is a strong possibility that different respondents in the research provide different kinds of responses to the questions. The purpose of this research is not to compare their views but to find out a breadth of information on if and how culture, gender and professional considerations affect design decisions.

The uniqueness of the research topic meant that in many cases the respondents did not have explicit information to share with the researcher. In such cases, researcher had to use examples to explain what kind of information researcher is seeking. Such strategy could sometimes mislead the respondents as they may start to seek similar examples which limit the breadth of information that the researcher is seeking.

Another limitation of interviews is that it can end up as a discussion on a topic completely irrelevant to the research. In order to maintain alignment with research questions researcher politely interrupted whenever the discussion drifted in other direction. Researcher maintained a list of questions to make sure all questions have been covered in the interview.

3.8.7 Other Considerations

Apart from the problems mentioned above, there are certain issues that the researcher had to take care of while collecting data for this research.

- Data Quality: It is not always possible to collect information on all the emotions expressed by the respondents because interviews were audio recorded and not video recorded. This is significant because there are vital cues in these emotions. To overcome this challenge researcher adopted the strategy proposed by Corbin and Strauss (2008) who recommended that interviewers should aim to capture all aspects of discussion including text and emotions. Researcher minimised the time duration between the interviews and completion of transcripts so to remember most of the aspects of the interview while preparing transcripts of interviews.
- Reliability and Validity: Reliability and validity are two big concerns in qualitative research. In order to achieve methodological coherence, researcher ensured that all the respondents had a good overview of the discussion and had ample time to prepare their responses by providing them with the sample questions at least a week in advance. The researcher also provided due explanation wherever required to make sure that the respondents understood the terms and could provide accurate responses. The researcher also used probing and asked respondents to give more than one example wherever possible to elicit their point. The sample size for this research was quite small but considering the quality and depth of real life experience knowledge that the respondents had a sample size of 11 was considered adequate. Interviews were conducted in a sequential manner so the knowledge gained from past interviews were used to ask

more informative questions in future interviews. While excerpts are taken for the purpose of the analysis but the whole of the interviews were transcribed.

- Ethical Issues: Since the research involved human participants there were some ethical considerations. This involved aspects such as full and unbiased disclosure of information (Barbour, 2007), voluntary participation and freedom to withdraw (Flick, 2007). It was made clear to all the respondents that no other form of compensation will be provided.

3.9 Ethical Approval

Since this research involves human participants ethical approval was obtained from the Brunel University's Ethical Committee. The details of the data collection process were provided to the ethics committee at the time of applying for the approval.

3.10 Summary

This chapter presented the research methodology selected for this research. Due to the complex nature of this research, it was considered essential to collect data in an innovative fashion. Research philosophy adopted for this research is pragmatic philosophy. Considering that the information sought for this research is unique but yet need to be generalised it was considered essential to adopt a philosophical approach which allows the flexibility of using multiple methods and both qualitative and quantitative strategy. While the quantitative strategy was essential for generalisation qualitative strategy was considered useful to understand in detail how design decisions are made and what kind of aspects are considered.

In line with pragmatic philosophy, this research adopts mixed methodology. A mixed methodology was essential to achieve the objectives of both depth and generalisation. While several past researchers have argued that gender, cultural and professional issues should be considered at the time of designing workplace but none of the past research has tested these empirically. Furthermore, there is a strong argument regarding the most effective measures of productivity. For this reason, the researcher believes that use of

multiple data collection methods and multiple research methods can be a useful way of obtaining a holistic perspective on the matter. Thus, mixed methodology was considered essential for this research.

Following this, the qualitative and quantitative methods are discussed in detail. One of the most significant contributions of this research is the development of a new data collection tool through a mobile app. Mobile phones are ubiquitous and can be very useful tool for non-invasive data collection methods. The usefulness of this new kind of data collection method was considered essential in this research because of the belief that in knowledge based non-manual roles the person can be the best judge of his/her own performance. Since this information cannot be perceived accurately by any other person hence external observation was considered not useful in this research. In addition, conventionally used measures of measuring the productivity of teachers were critiqued and found to lack in various ways. Hence this research decided to use a self-reported measure of productivity. Since workplace environment affects productivity on a continuous and daily basis it was essential to collect real-time information and ubiquity of mobile phone's made these as the most suitable data collection tool for this research.

Qualitative data was collected using semi-structured interviews with designers who have worked on projects involving designing of all-female universities in Saudi Arabia. Different aspects of qualitative data collection including validity and reliability and challenges faced were discussed in this chapter.

Sampling for both qualitative and quantitative research was also discussed in the relevant sections. Finally, ethical issues for this research were discussed.

The next chapter presents the analysis of the data.

4. Data analysis

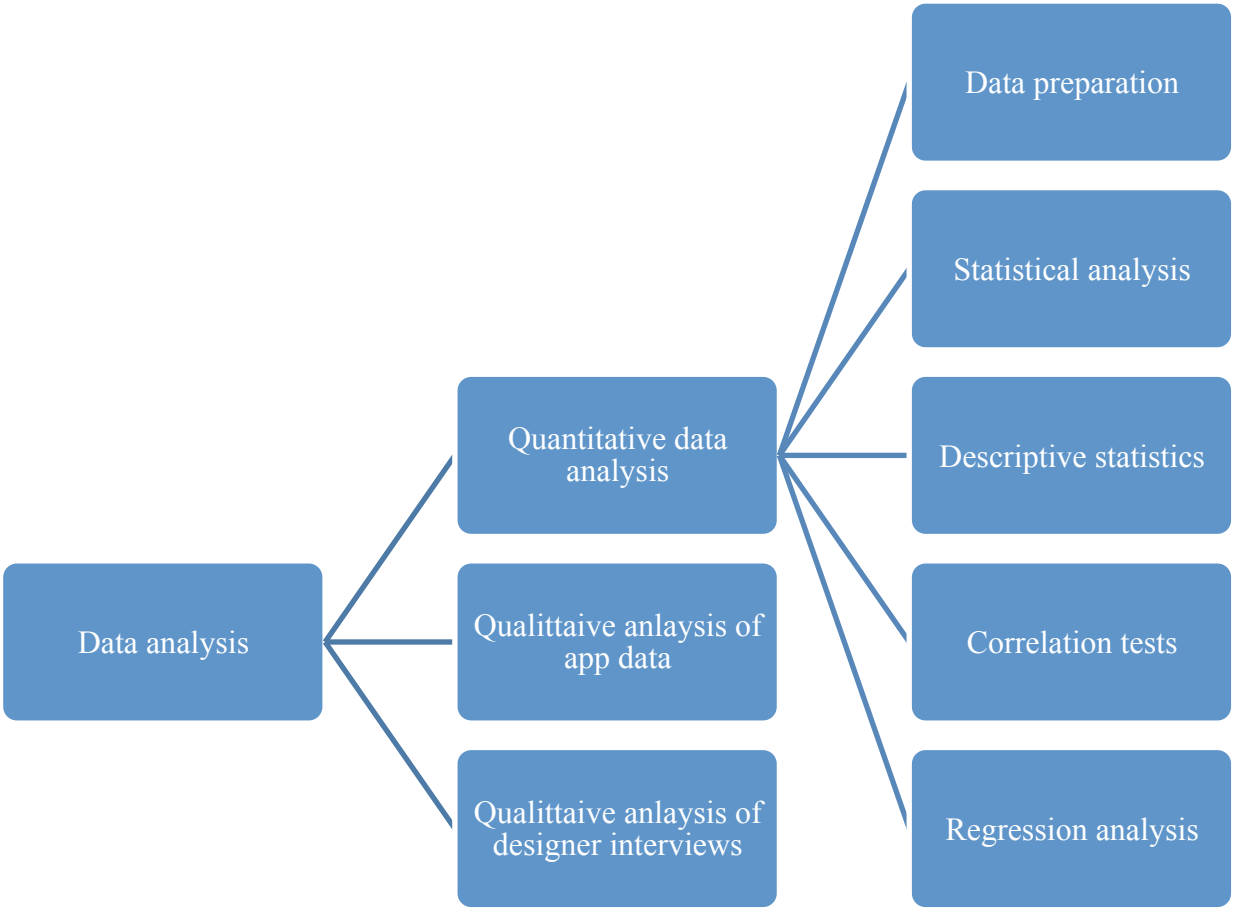


Figure 24: Structure of chapter 4

This chapter present analysis of the qualitative and quantitative data. Data collected through the app is analysed both quantitatively and qualitatively. The qualitative analysis of app data is aimed at providing some insight into the responses provided by the respondents so that the reader gets a better understanding of the findings of quantitative data analysis.

4.1 Quantitative data analysis

4.1.1 Preparing data

This is a mixed methods research. Some researchers turn to mixed methods after an initial round of analysis is completed in order to explain contradictory findings (Creamer, 2011; Creswell and Plano Clark, 2007). Quantizing refers to the process of assigning numerical values to data collected through interviews, observation, or media analysis (Sandelowski, Voils and Knafl, 2009).

For a variety of reasons, there has been an increasing need in cognitive science to collect and analyse "messy" data. Messy data refer to such things as verbal explanations, observations, and video tapings, as well as gestures. One reason for the need to collect this kind of data is the trend toward studying complex activities in practice or in the context in which they occur (Creamer, 2011; Chi, 1997). In this research also the researcher had to collect messy qualitative data to understand people's experiences in their own words. Since people may have different experiences and may use different words to express their experiences, the data in this research was particularly messy i.e. unstructured. However, it was realised that testing the data for generalisation is essential to be able to conclude how workplace design affects employee productivity in Saudi all-female universities. Hence quantization approach was used to convert the qualitative data from the mobile app into quantitative data which could be statistically analysed.

The whole data analysis process began with quantification of qualitative data. As mentioned before the data from the app was obtained in qualitative format. Respondents were requested to send their comments in the language and wording they found appropriate. The purpose behind this was to capture the real essence of how the respondent was feeling. The structured approach would not have captured the true essence respondents experience/ perception of the workplace design and how it is affecting her. Thus, the researcher wanted to give the respondents complete freedom in reporting their experience of the workplace design.

However, for analysing this data it was essential to structure this data. The theoretical framework presented at the end of chapter 2 was used for purpose of quantification. Author analysed each instance of a comment. Comments which were not found to be

relevant to the study were ignored and put in a separate list. This list was reviewed again by the researcher and two fellow researchers to see if it was the right decision to ignore these comments. For example, the comment “my workplace is too far from my home and I think I waste 2 hours every day of my life in the car” was found to be irrelevant to this research because it talks about aspects other than workplace design.

For the responses which were found to be relevant a specific coding technique was used. Researcher manually coded each and every response. Each response comprised of three responses. The first response was an open response submitted by the respondent. Respondent identified some aspect of workplace design which they believed affected their productivity and sent the comment to the researcher using the mobile app. This was under the “design considerations” part of the conceptual framework. Following registering of first response, an automated question was generated asking the respondent to provide a specific response which related to the “quality of workplace design” part of the conceptual framework. Finally, another question was automatically asked which related to the “productivity” part of the conceptual framework. In cases when the respondent sent only particle responses (for example when the respondents failed to answer question 2 or 3) the response was registered as incomplete and was discarded.

The existence of any themes forms the conceptual framework was coded as 1 (representing Yes) or -1 (representing No). An example of coding is given in the table below:

Comment	Theme	Value assigned
I don't like our common area because I have to sit face to face with students and that makes me uncomfortable	Cultural considerations - Power distance	1- This value indicates the lack of consideration for cultural factor (power distance)
I like the seating arrangement in the seminar room. I can communicate with all students while sitting in my chair.	Professional considerations – nature of work	1- This value indicates that designer has given due professional consideration by keeping nature of work in mind while designing sitting plan in the seminar room.

Non-existent theme for each response was assigned value 0 by default. Following these the average of responses for each subtheme was calculated for each individual response and data was then statistically analysed.

In total 64 individuals attended the first debriefing sessions. Out of these 59 individuals agreed to install the app on their phones. However, only 37 profiles were created which indicates that 37 individuals agreed to participate in the research. In total 37 respondents sent 1732 responses. Out of these 137 responses were irrelevant and 512 responses were incomplete. The final number of responses used for data analysis was 1083. Although the number of respondents was only 37 but the number of observations was sufficiently high to carry out quantitative analysis. 37 respondents used the app for 3 weeks i.e. 15 working days. This equates to 555 days of self-observation reported which is considered sufficient enough for a meaningful analysis. This means that on average the respondents sent around 2 responses per day. This is considered sufficient because the respondents were requested to send only that piece of information which related to workplace design and which, in their opinion, affected them in some way. They are not asked to actively look for such issues but rather report these as they encounter these in their day to day life.

Also, the respondents were asked to refrain from reporting during the lectures and send comments only when they were not engaged in any official work.

The researcher agreed with the managements of the universities included in this research that researcher will run just one session to recruit the participants. There was thus, no possibility for the respondent to increase the number of participants. Thus, the researcher had 555 days of self-observation data which was considered sufficient for meaningful analysis.

4.1.2 Statistical analysis

The first set of models that were tested was to investigate whether design consideration affects employees' perception of quality of workplace design. Here it was investigated whether the current design of the university takes into consideration cultural, professional and gender aspects of the employees and whether these considerations or lack thereof will affect employees' perception of the quality of workplace design. The quality of workplace design here refers to whether the workplace has a positive or negative impact on functional, psychological or social output of the employee.

Three regression models were prepared one each of each of the factors characterising the quality of workplace design as the dependent variable. In all the three models the independent variables were the design considerations.

4.1.3 Correlation test

Correlation tests are used to assess whether there is a relationship between two or more continuous (interval or ratio) variables. The output of correlation test is given on next page:

Table 10: Correlation test results

Correlations

		Cultural considerations	Professional considerations	Gender considerations	Functional quality	Psychological quality	Social quality	Employee_outcome	Organisational_outcome
Cultural considerations	Pearson Correlation	1	-.086**	-.056	-.045	.334**	.765**	.297**	-.064*
	Sig. (2-tailed)		.005	.067	.135	.000	.000	.000	.035
	N	1083	1083	1083	1083	1083	1083	1083	1083
Professional considerations	Pearson Correlation	-.086**	1	-.104**	.728**	-.036	-.216**	-.071*	.376**
	Sig. (2-tailed)	.005		.001	.000	.237	.000	.019	.000
	N	1083	1083	1083	1083	1083	1083	1083	1083
Gender considerations	Pearson Correlation	-.056	-.104**	1	-.054	.416**	.043	.344**	.046
	Sig. (2-tailed)	.067	.001		.078	.000	.159	.000	.132
	N	1083	1083	1083	1083	1083	1083	1083	1083
Functional quality	Pearson Correlation	-.045	.728**	-.054	1	.035	-.035	-.015	.576**
	Sig. (2-tailed)	.135	.000	.078		.247	.247	.617	.000
	N	1083	1083	1083	1083	1083	1083	1083	1083
Psychological quality	Pearson Correlation	.334**	-.036	.416**	.035	1	.437**	.781**	.004
	Sig. (2-tailed)	.000	.237	.000	.247		.000	.000	.898
	N	1083	1083	1083	1083	1083	1083	1083	1083
Social quality	Pearson Correlation	.765**	-.216**	.043	-.035	.437**	1	.440**	-.043
	Sig. (2-tailed)	.000	.000	.159	.247	.000		.000	.161
	N	1083	1083	1083	1083	1083	1083	1083	1083
Employee_outcome	Pearson Correlation	.297**	-.071*	.344**	-.015	.781**	.440**	1	-.080**
	Sig. (2-tailed)	.000	.019	.000	.617	.000	.000		.009
	N	1083	1083	1083	1083	1083	1083	1083	1083
Organisational_outcome	Pearson Correlation	-.064*	.376**	.046	.576**	.004	-.043	-.080**	1
	Sig. (2-tailed)	.035	.000	.132	.000	.898	.161	.009	
	N	1083	1083	1083	1083	1083	1083	1083	1083

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

As per the results, functional quality of workplace design is correlated with professional consideration in workplace design. This indicates that it may be possible to improve functional quality of workplace design by paying attention to professional considerations while designing workplaces. Similarly, cultural considerations and gender considerations are found to have a statistically strong correlation with psychological quality of workplace design. Cultural and professional considerations are found to have a statistically strong correlation with social quality of workplace design. Psychological quality and workplace design and social quality of workplace design were found to have a statistically strong correlation with employee outcomes of productivity.

Correlation, however, merely tells us that the variables are moving in the same or opposite direction but tell us nothing about whether there is any causal relationship between the variables- i.e. they are moving in the same direction but is one of the variables causing another variable to move.

This problem can be resolved through regression which helps us establish a causal relationship. The present study has used the 5% level of significance to reject the null hypotheses formulated at the start of the study.

4.1.5 Regression Test

The first regression model tested the following three hypotheses:

Hypothesis H_1: Cultural considerations during workplace designing improves functional quality of workplace design in Saudi Arabian all-female universities.

Hypothesis H_2: Professionals considerations during workplace designing improves functional quality of workplace design in Saudi Arabian all-female universities

Hypothesis H_3: Gender considerations during workplace designing improves functional quality of workplace design in Saudi Arabian all-female universities

Researcher conceived the following model to test for the relationship between *functional quality of workplace design* and the three kinds of workplace design considerations (cultural, professional and gender), that is, to determine whether considering these three aspects during workplace designing will have a statistically significant impact on *functional quality of workplace design*.

Functional_quality = α_0 + α_1* cultural_considerations + α_2* professional_considerations + α_3* gender_considerations

Where α_0, α_1, α_2, α_3, are coefficients of regression.

The table below gives the output of the regression test

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Gender considerations, Cultural considerations, Professional considerations[b]	.	Enter

a. Dependent Variable: Functional quality

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.728[a]	.530	.529	.1581631

a. Predictors: (Constant), Gender considerations, Cultural considerations, Professional considerations

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	30.460	3	10.153	405.886	.000[b]
	Residual	26.992	1079	.025		
	Total	57.452	1082			

a. Dependent Variable: Functional quality

b. Predictors: (Constant), Gender considerations, Cultural considerations, Professional considerations

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.026	.011		-2.436	.015
	Cultural considerations	.024	.027	.019	.893	.372
	Professional considerations	.640	.018	.732	34.723	.000
	Gender considerations	.012	.011	.024	1.129	.259

a. Dependent Variable: Functional quality

Table 11: Regression model 1 output

The value of Adj-R^2 is close to R^2 indicating that the sample has a sufficient number of cases. The adjusted R-squared value of 0.529 indicates that the three design considerations (culture, profession and gender) included in the model can explain up to 52.9 percent variation in the values of functional quality of workplace design. This is quite high indicating that functional quality of workplace design can be significantly improved by paying attention to professional aspects of workplace design. This is understandable because workplaces designed keeping the nature of profession in mind can work as enablers/ facilitators/ motivators for the employees. This will have an impact on the functional quality of the workplace. This is quite interesting in this research because this proves that despite the intellect based nature of teachers' work, workplace design does affect their ability to function properly. In cases of mechanical work, this assumption is quite intuitional because poorly designed workplaces can create hurdles in mechanical work. This research finds that even for intellectual and creative professions like teaching the workplace design can affect the functional quality. At the same time, this regression model did not find any causal link between cultural consideration and

functional quality of the workplace and between gender considerations and functional quality. This could be because the functional aspects of work are not affected by culture and gender of the occupants; for example, a teacher has to be creative in teaching and their ability to be creative will not be affected by their gender or culture.

The second regression model tested the following three hypotheses:

Hypothesis H_4: Cultural considerations during workplace designing improves the psychological quality of workplace design in Saudi Arabian all-female universities.

Hypothesis H_5: Professionals considerations during workplace designing improves psychological quality of workplace design in Saudi Arabian all-female universities

Hypothesis H_6: Gender considerations during workplace designing improves psychological quality of workplace design in Saudi Arabian all-female universities

Researcher conceived the following model to test for the relationship between *psychological quality of workplace design* and the three kinds of workplace design considerations (cultural, professional and gender), that is, to determine whether considering these three aspects during workplace designing will have a statistically significant impact on *psychological quality of workplace design*.

Psychological_quality = α_0 + α_1* cultural_considerations + α_2* professional_considerations + α_3* gender_considerations

Where α_0, α_1, α_2, α_3, are coefficients of regression

The table below gives the output of the regression test

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Gender considerations, Cultural considerations, Professional considerations[b]	.	Enter

a. Dependent Variable: Psychological quality

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.550[a]	.303	.301	.2121

a. Predictors: (Constant), Gender considerations, Cultural considerations, Professional considerations

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	21.083	3	7.028	156.181	.000[b]
	Residual	48.552	1079	.045		
	Total	69.635	1082			

a. Dependent Variable: Psychological quality

b. Predictors: (Constant), Gender considerations, Cultural considerations, Professional considerations

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.024	.014		1.676	.094
	Cultural considerations	.513	.036	.362	14.170	.000
	Professional considerations	.040	.025	.041	1.601	.110
	Gender considerations	.249	.014	.440	17.191	.000

a. Dependent Variable: Psychological quality

Table 12: Regression model 2 output

Psychological quality referred to controllability and privacy because it affects the employee's perception about how much autonomy she has. It was found in the literature

review that ability to control the workplace and to maintain privacy can lead to improved psychological well-being of individuals.

The adjusted R-squared value of 0.301 indicates that three design consideration (gender, profession and culture) included in the model can explain up to 30.1 percent variation in the values of psychological well-being of employees. In this respect, the regression model reveals that cultural considerations and gender considerations have statistically significant impact on the psychological wellbeing of the employees while professional considerations at the time of workplace designing may not have any statistically significant impact on the psychological wellbeing of the employees. From these findings, it could be inferred that psychological wellbeing is more affected by personal aspects of workplace design. Culture and gender are personal aspects of workplace design considerations included in the conceptual framework and this regression model reveals that personal aspects of workplace design can have a statistically significant impact on the psychological wellbeing of the employees.

The third regression model tested the following three hypotheses:

Hypothesis H_7: Cultural considerations during workplace designing improves social quality of workplace design in Saudi Arabian all-female universities.

Hypothesis H_8: Professionals considerations during workplace designing improves social quality of workplace design in Saudi Arabian all-female universities

Hypothesis H_9: Gender considerations during workplace designing improves social quality of workplace design in Saudi Arabian all-female universities

Researcher conceived the following model to test for the relationship between *social quality of workplace design* and the three kinds of workplace design considerations (cultural, professional and gender), that is, to determine whether considering these three aspects during workplace designing will have a statistically significant impact on *social quality of workplace design*.

Social_quality = α_0 + α_1* cultural_considerations + α_2* professional_considerations + α_3* gender_considerations

Where α_0, α_1, α_2, α_3, are coefficients of regression.

The table below gives the output of the regression test

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Gender considerations, Cultural considerations, Professional considerations[b]	.	Enter

a. Dependent Variable: Social quality

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.783[a]	.612	.611	.1032997

a. Predictors: (Constant), Gender considerations, Cultural considerations, Professional considerations

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	18.194	3	6.065	568.341	.000[b]
	Residual	11.514	1079	.011		
	Total	29.708	1082			

a. Dependent Variable: Social quality

b. Predictors: (Constant), Gender considerations, Cultural considerations, Professional considerations

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.068	.007		9.672	.000
	Cultural considerations	.700	.018	.756	39.673	.000
	Professional considerations	-.090	.012	-.144	-7.512	.000
	Gender considerations	.026	.007	.070	3.659	.000

a. Dependent Variable: Social quality

Table 13: Regression model 3 output

Social wellbeing referred to communication, collaboration and knowledge exchange. There are both personal and professional aspects of social wellbeing of individuals. They need interpersonal interaction in order to be able to collaborate but at the same time, their collaboration needs to be in both personal and professional context (such as for knowledge exchange).

.

The adjusted R-squared value of 0.611 indicates that three design consideration (gender, profession and culture) included in the model can explain up to 61.1 percent variation in the values of social well-being of employees. This is quite high probably because the factors included have a strong link with social wellbeing. For example, culture represents social norms and hence considering culture is expected to have a positive and significant impact on social wellbeing. This regression model found that cultural, gender and professional considerations, all have a statistically significant impact on the social well-being of individuals. Thus professional, gender and cultural considerations during workplace designing is likely to improve social wellbeing of individuals

The fourth regression model tested the following three hypotheses:

Hypothesis H_{10}: Functional qualities of workplace design affect employee outcomes in Saudi Arabian all-female universities.

Hypothesis H_{11}: Psychological qualities of workplace design affect employee outcomes in Saudi Arabian all-female universities.

Hypothesis H_{12}: Social qualities of workplace design affect employee outcomes in Saudi Arabian all-female universities.

Researcher conceived the following model to test for the relationship between *Employee outcomes* and the three kinds of workplace design quality (functional, psychological, social), that is, to determine whether achieving these three kinds of satisfactions will have a statistically significant impact on *employee outcomes*.

Employee_outcomes = α_0 + α_1* Functional_quality + α_2* Psychological_quality + α_3* Social_quality

Where α_0, α_1, α_2, α_3, are coefficients of regression.

The table below gives the output of the regression test

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Social quality, Functional quality, Psychological quality[b]	.	Enter

a. Dependent Variable: Employee_outcome

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.789[a]	.623	.622	.1018156

a. Predictors: (Constant), Social quality, Functional quality, Psychological quality

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	18.488	3	6.163	594.496	.000[b]
	Residual	11.185	1079	.010		
	Total	29.674	1082			

a. Dependent Variable: Employee_outcome

b. Predictors: (Constant), Social quality, Functional quality, Psychological quality

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.031	.005		5.705	.000
	Functional quality	-.026	.013	-.037	-1.961	.050
	Psychological quality	.477	.014	.730	35.076	.000
	Social quality	.119	.021	.119	5.715	.000

a. Dependent Variable: Employee_outcome

Table 14: Regression model output

In this research, productivity is defined as comprising of two factors- employee outcomes and organisational outcomes. Employee outcomes included stress, motivation, psychological and physiological outcomes. Employee outcomes relate to how well the employee's personal/ intrinsic goals are achieved. Achievement of these goals is expected to help the employees in achieving organisational goals.

The regression model indicates that all three kinds of well-being factors i.e. functional, psychological and social wellbeing affect employee outcomes. This means by improving the functional, psychological and social wellbeing of employees it is possible to achieve better employee outcomes. The composition of employee outcome aspects indicates that better employee outcomes refer to more satisfied and motivated employees.

The fifth regression model tested the following three hypotheses:

Hypothesis H_{13}: Functional quality of workplace design affect organisational outcomes in Saudi Arabian all-female universities.

Hypothesis H_{14}: Psychological quality of workplace design affect organisational outcomes in Saudi Arabian all-female universities.

Hypothesis H_{15}: Social quality of workplace design affect organisational outcomes in Saudi Arabian all-female universities.

Researcher conceived the following model to test for the relationship between *organisational outcomes* and the three kinds of workplace design quality (functional, psychological, social), that is, to determine whether achieving these three kinds of satisfactions will have a statistically significant impact on *organisational outcomes*.

$$\text{Organisational\_outcomes} = \alpha_0 + \alpha_1 * \text{Functional\_quality} + \alpha_2 * \text{Psychological\_quality} + \alpha_3 * \text{Social\_quality}$$

Where α_0, α_1, α_2, α_3, are coefficients of regression.

The table below gives the output of the regression test

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Social quality, Functional quality, Psychological quality[b]	.	Enter

a. Dependent Variable: Organisational_outcome

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.577[a]	.333	.331	.2096

a. Predictors: (Constant), Social quality, Functional quality, Psychological quality

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	23.619	3	7.873	179.219	.000[b]
	Residual	47.401	1079	.044		
	Total	71.020	1082			

a. Dependent Variable: Organisational_outcome

b. Predictors: (Constant), Social quality, Functional quality, Psychological quality

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.057	.011		5.131	.000
	Functional quality	.640	.028	.576	23.102	.000
	Psychological quality	-.008	.028	-.008	-.294	.769
	Social quality	-.029	.043	-.019	-.679	.497

a. Dependent Variable: Organisational_outcome

Table 15: Regression model output

Organisational outcomes refer to direct employee productivity in terms of quality of output and absenteeism. Needless to say, better organisational outcomes in the context of the university will include better quality of learning for the students. The regression model indicates that functional quality or functional wellbeing of employees is directly related to organisational outcomes. This means by improving functional aspects of workplace design in a way so that it improves the functional output of employees it is possible to achieve better organisational outcomes.

The sixth and final regression model tested the following hypothesis:

Hypothesis H_{16}: Employee outcomes affect organisational outcomes in Saudi Arabian all-female universities.

Researcher conceived the following model to test for the relationship between *organisational outcomes* and the employee outcomes, that is, to determine whether achieving superior employee outcomes will have a statistically significant impact on *organisational outcomes*.

$Organisational\_outcomes = \alpha_0 + \alpha_1 * Employee\_outcomes$

Where α_0, α_1 are coefficients of regression

The table below gives the output of the regression test

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Employee_outcome[b]	.	Enter

a. Dependent Variable: Organisational_outcome

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.080[a]	.006	.005	.2555

a. Predictors: (Constant), Employee_outcome

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.450	1	.450	6.888	.009[b]
	Residual	70.570	1081	.065		
	Total	71.020	1082			

a. Dependent Variable: Organisational_outcome

b. Predictors: (Constant), Employee_outcome

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.217	.010		21.812	.000
	Employee_outcome	-.123	.047	-.080	-2.624	.009

a. Dependent Variable: Organisational_outcome

Table 16: Regression model output

The findings of this regression model indicate the employee outcomes also contribute to the achievement of organisational outcomes. In other words, more satisfied and motivated teachers are likely to provide a better quality of teaching and are less likely to be absent from work. This is significant because it indicates that there is a possibility of boosting the performance of the teachers in terms of quality of education they provide by boosting their own satisfaction levels.

Thus, based on the six regression models the following outcomes were obtained for the tested hypotheses:

Hypothesis	Regression model	Outcome
Hypothesis H_1: Cultural considerations during workplace designing improves functional quality of workplace design in Saudi Arabian all-female universities.	Model 1	Rejected
Hypothesis H_2: Professionals considerations during workplace designing improves functional quality of workplace design in Saudi Arabian all-female universities	Model 1	Accepted
Hypothesis H_3: Gender considerations during workplace designing improves functional quality of workplace design in Saudi Arabian all-female universities	Model 1	Rejected
Hypothesis H_4: Cultural considerations during workplace designing improves the psychological quality of workplace design in Saudi Arabian all-female universities.	Model 2	Accepted
Hypothesis H_5: Professionals considerations during workplace designing improves the psychological quality of workplace design in Saudi Arabian all-female universities.	Model 2	Rejected
Hypothesis H_6: Gender considerations during workplace designing improves the psychological quality of workplace design in Saudi Arabian all-female universities	Model 2	Accepted
Hypothesis H_7: Cultural considerations during workplace designing improves social quality of workplace design in Saudi Arabian all-female universities.	Model 3	Accepted

Hypothesis H_8: Professionals considerations during workplace designing improves social quality of workplace design in Saudi Arabian all-female universities	Model 3	Accepted
Hypothesis H_9: Gender considerations during workplace designing improves social quality of workplace design in Saudi Arabian all-female universities.	Model 3	Accepted
Hypothesis H_{10}: Functional quality of workplace design affect employee outcomes in Saudi Arabian all-female universities.	Model 4	Accepted
Hypothesis H_{11}: Psychological quality of workplace design affect employee outcomes in Saudi Arabian all-female universities.	Model 4	Accepted
Hypothesis H_{12}: Social quality of workplace design affect employee outcomes in Saudi Arabian all-female universities.	Model 4	Accepted
Hypothesis H_{13}: Functional quality of workplace design affect organisational outcomes in Saudi Arabian all-female universities.	Model 5	Accepted
Hypothesis H_{14}: Psychological quality of workplace design affect organisational outcomes in Saudi Arabian all-female universities.	Model 5	Rejected
Hypothesis H_{15}: Social quality of workplace design affect organisational outcomes in Saudi Arabian all-female universities.	Model 5	Rejected
Hypothesis H_{16}: Employee outcomes affect organisational outcomes in Saudi Arabian all-female universities.	Model 6	Accepted

Table 17: Summary of hypothesis test results

Based on the tests for each hypothesis, the following model is validated

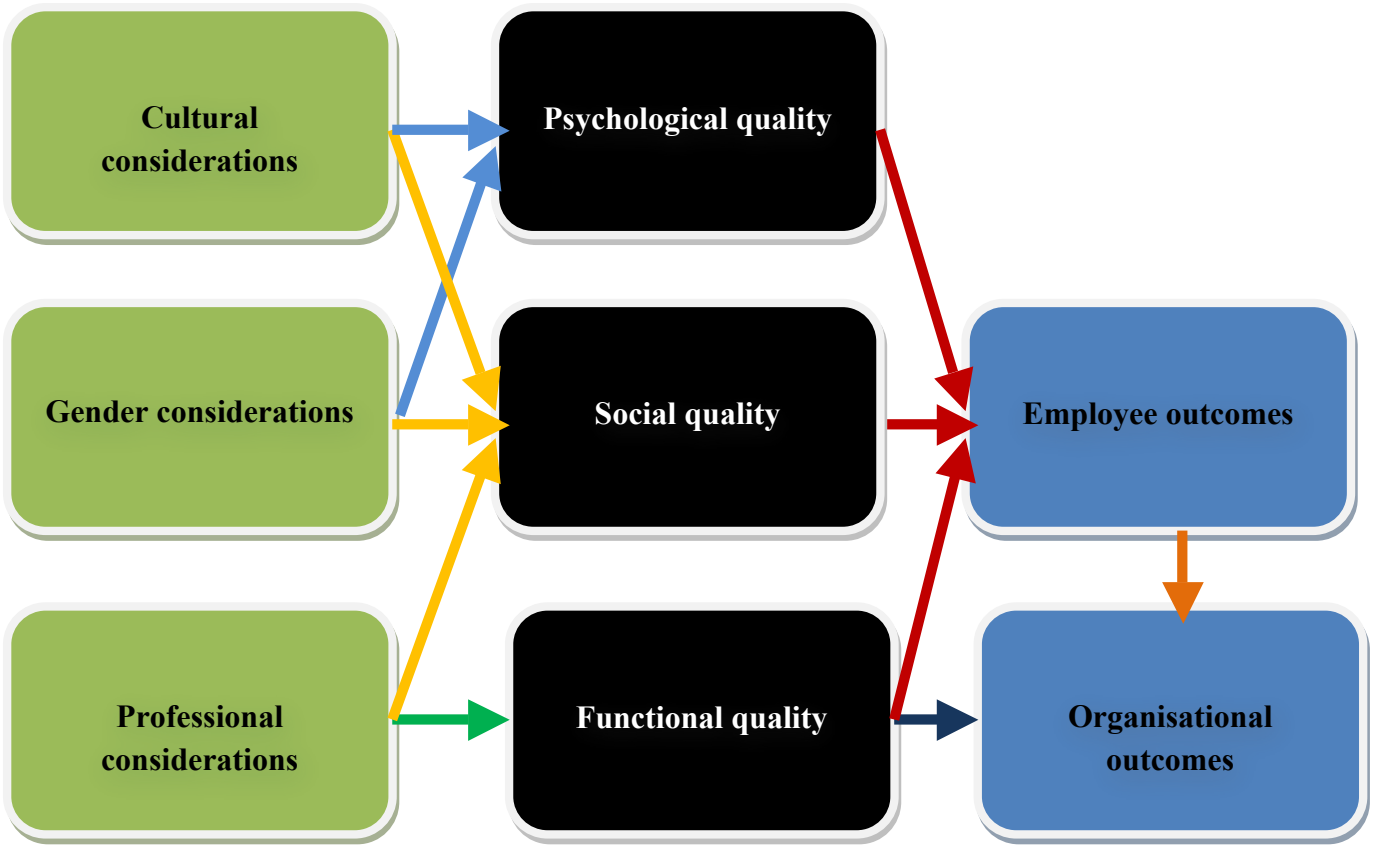


Figure 25: Final theoretical framework

4.1.6 Qualitative analysis of app data

Purpose of his qualitative data analysis is not to develop the relationship between the variables but rather to present the reader with some insight into the comments which highlighted how lack of consideration of different attributes at the time of designing may be affecting employees' perception of the quality of workplace across different dimensions and consequently their ability to achieve organisation or employee objectives.

The table below shows the frequency of repetition of themes.

	Functional quality and outcome	Frequency	Number of comments
F1	Accessibility (It makes it difficult for me to access what I want to access)	8.2%	89
F2	Alignment with nature of work (It is not suitable for teaching job/ university environment)	24.6%	265
F3	Support work processes (It makes it difficult for me to work)	20.1%	217
P1	Controllability (I feel like I do not have any control over my environment)	20.1%	217
P2	Privacy (It affect my privacy)	18.9%	204
S1	Communication (I find it difficult to communicate with other teachers/ students)	24.2%	261
S2	Collaboration (It makes it difficult for me to work with teachers/ students)	21.2%	229
S3	Knowledge exchange (It makes it difficult for me to exchange information/ knowledge with teachers/ students)	13.3%	144
EO1	Stress (I feel stressed because of this)	31.2%	337
EO2	Physiological (I feel pain/ tiredness due to this)	16.8%	181
EO3	Psychological (It affects me emotionally/ mentally)	20.2%	218
OO1	Quality of outputs (This affects my ability to do my job)	28.6%	309
OO2	Absenteeism (I feel like not coming to work because of this)	26.0%	281

Table 18: Frequency analysis of key themes in mobile app data

Respondents provided strong support for improving the functional quality of the workplace. 44 percent of the responses received were related to factors affecting the ability of individuals to function properly. A number of respondents also complained about the lack of control and personalisation of space. For example, one of the respondents commented:

"*I feel that I am a prisoner here. It feels so restricted. I hate being in the staff room*." Furthermore, she suggested that this affects her perception of the psychological quality of the workplace and consequently her ability to perform her duty towards the students.

Another respondent commented:

> "*I don't feel comfortable. I will like to change a few things here. Especially the lights are too bright for me. It gives me a headache*."

On the other hand, another respondent commented:

> "*I think there is not enough light in my room. I will like to add some more lights... I hate yellow lights but they will not change it for me*."

Furthermore, another respondent commented:

> "*I cannot change anything in my room. I want to move the desk but I can't. I want to change the lights, I can't. I want to adjust my chair, I can't. This is annoying. I feel anxious all the time*."

These responses indicate that people can have somewhat different preferences and as individuals personalisation of their needs and preferences must be respected. This personalisation is linked with both gender and culture considerations because Saudi females tend to personalise their space. They face restriction on outdoor activity but inside the homes, they tend to control the environment. Since old times, in Saudi culture, women act as designers of the house. These views confirmed the link between gender and culture considerations and perceived the psychological quality of the workplace. Furthermore, the respondents also confirmed that lack of ability to personalise their work environment left them stressed or physically and/or emotionally drained. In other words, they indicated that this affected their ability to achieve 'employee outcomes'. This confirms the findings of the self-reported observation data.

Some respondents even suggested that the lack of ability to personalise workplace environment affects the perceived functional quality of the workplace. Personalisation of space is particularly critical in professions where individuals work in an individualised manner. As one of the respondents commented:

"*I need total quiet and peace to focus on my work. I feel so distracted with the noise. I cannot focus on my work even with the door closed*."

Another respondent commented:

"*I feel so comfortable at home. I can be what I want to be and feel so creative there. But as soon as I enter the university I feel stressed and forget everything. Just want to get out of here*."

In one of the universities, teachers had no individual space but were rather required to share space. This lack of control over the workspace had a significant bearing on the performance of the teachers as highlighted by one respondent:

"*I cannot imagine that I do not have a room for myself. How can they expect teachers to be sharing space and still focus on their work? I cannot prepare my lessons properly. It is like a primary school*."

University teachers require personalisation of their workspace and in this was considered as one of the most critical factors affecting functional quality in most of the comments. Words such as "anxiety" and "stress" highlighted the feelings that respondents felt while working and according to the respondents it affects their ability to perform their tasks properly. Teaching job requires a lot of reading and this required focus. Environmental factors should assist teachers in focusing rather than distracting them. No two individuals are the same and their preferences vary as well. Consequently, personalisation of space is required to provide teachers with the right environment, from their own perspective, to focus on their work. In terms of personalisation, the individuals expressed preferences for different aspects. For example, most of the respondents talked about control over light with some complaining it was either too bright or not adequately placed. For example, some ceiling lights tend to reflect back through glass surfaces or laptop screens making it difficult for the individuals to work. This can affect their productivity. Second most cited factor in terms of personalisation was the layout of the room. For example, one individual complained:

"*As part of my work I need students to bring models of physics. I don't have space to keep those. I tried leaving them on the floor but damaged quite a few and I feel so sad to have destroyed my student's hard work. I need proper shelves to keep and even display my student's work but there is no space for that*."

This particular further responded that it affects their ability to dispense their duties.

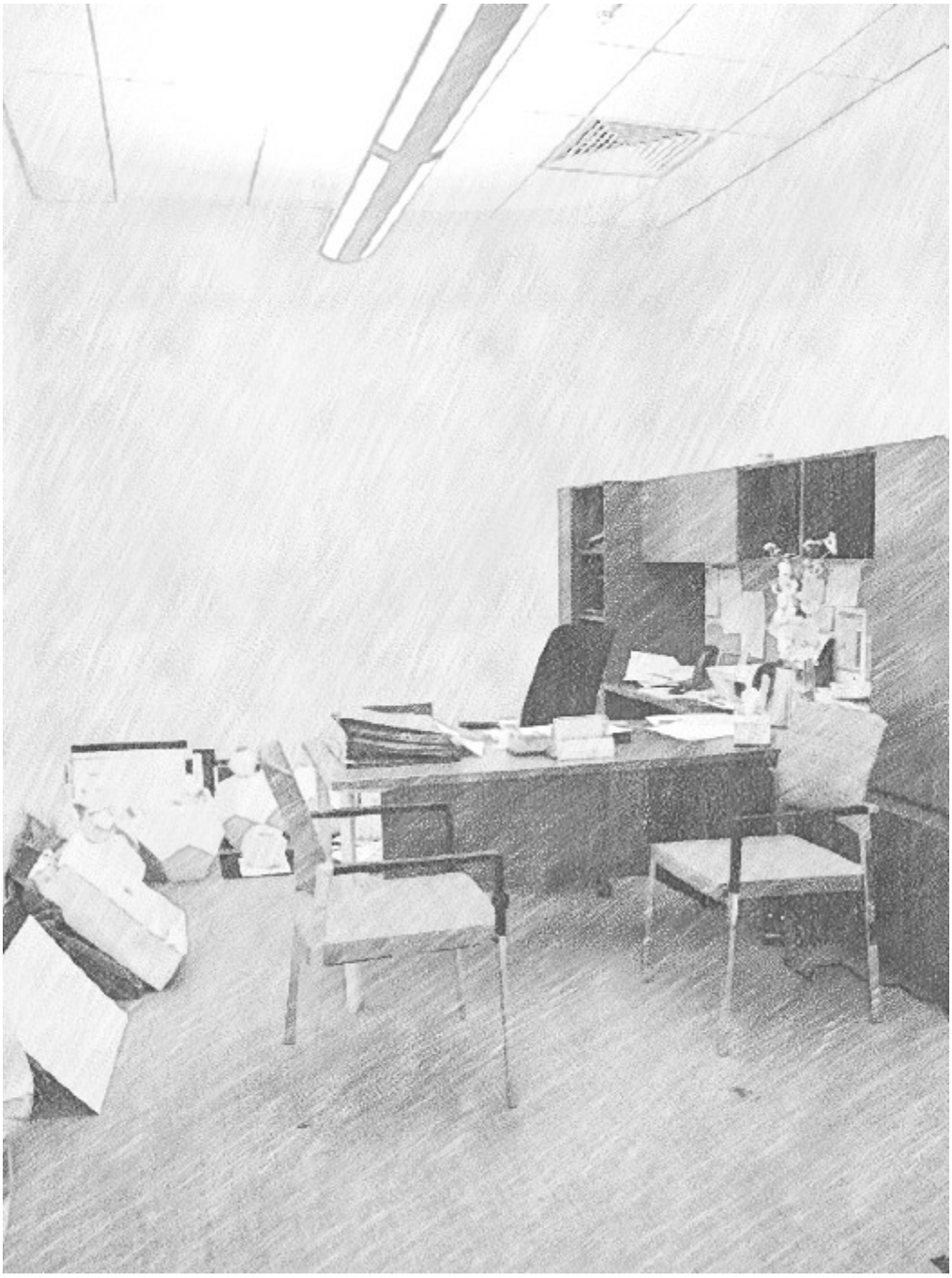


Figure 26: Image of a teacher's room with projects lying around and no windows. Source: Self[1]

[1]Picture taken by the researcher with the permission of the university. Images are deliberately blurred to make it difficult to identify the location where the photograph was taken.

Another teacher complained:

> "*I have hurt myself so many times with this table. And there is nothing I can do about this. I don't need this but I cannot remove it*."

Another teacher complained about the furniture:

> "*Working on this table and chair gives me back pain. I just don't want to come to this office. I cannot even adjust the height of my chair*."

One more teacher complained:

> "*I have no space for more chairs or even stools in my room. So I cannot invite more than two students in my room for discussion because there is nowhere to sit and no way to make space. At least allow me to make some space when I need*."

These comments indicate that occupants wanted the ability to control different aspects of the furniture and layout. The standardisation of furniture is a major issue at most workplaces.

Some individuals also complained about the colours in their rooms which gives a depressing feeling. For example, one user complained:

> "*If I keep the lights on it is too bright. If I open the window, it gets too warm. If I close the window and switch off the lights I cannot see anything. Who designed this place*?"

Another teacher commented:

> "*This room looks so dispiriting. The moment I come in I feel sad. Just some books and furniture; no character. No life. It feels like a cage*."

Teachers also complained about the monotonous interior design of the building. Many individuals complained that they do not feel inspired or motivated when they come to work. As one of the teachers put it:

> "*It feels like a hospital or a prison. There is so much emptiness and every face I see looks so gloomy. I like everything about my work but not this building. I would rather sit in a garden rather than here*."

These comments indicate dissatisfaction with several aspects of the indoor environment. Above all different individuals commented about different aspects such as lights, furniture layout, space management, temperature, colour etc. The comments strongly indicate the desire for personalisation of the indoor environment. While it is not possible to personalise the common areas but what is striking is the desire to personalise the office space. In this respect, the designers indicated that individuals can be given options to personalise the workspace. For example, instead of dark windows, windows with blinds and instead of simple light switches, light regulators can be useful options.

Apart from personal control/ personalisation the second aspect that was most frequently commented by the respondents was the responsiveness of the workplace to the functional, physical and social needs of the occupants. 38 percent of the comments discussed responsiveness of the workplace and suggested that the workplace seems to inhibit their creative ability rather than facilitating/ promoting it.

Figure 27: Image of a classroom. Source: Self[2]

Many respondents had comments about the poor layout of the classrooms. For example one of the respondents commented on the layout of classrooms:

> "*Classrooms are rectangle shaped with around 15 rows. I cannot make eye contact with people beyond two or three rows. I saw in UK universities they have semi-circular layout with the depth of around 5 rows. That was amazing. This is making it so difficult for me to communicate*."

Another teacher commented

> "*Seating arrangements in classrooms makes it difficult to give lessons. People at the back cannot hear me and I cannot hear them either. If I go to the middle then I can only look forward or backwards so there is always a group of people missing out*."

The Same respondent commented:

[2]Picture taken by the researcher with the permission of the university. Images are deliberately blurred to make it difficult to identify the university.

"*many times some individual raises an intelligent question but only half of the class at best can hear what was the question raised and what was my answer."*

Another respondent commented:

"There is a lack of participation and I can see people's faces: bored and not interested in the lessons. I don't blame them because they cannot hear anything."

Another teacher gave the gender dimension to this:

"*during those days I cannot walk too much so I just sit in front of the class and do nothing. To give a lecture I need to walk up and down because most students cannot hear me properly*."

Seating arrangements like this make it difficult for teachers to have interactive sessions with the whole class. Only those sitting right in the front of the speaker get to interact and while those seated far away may find it difficult to understand or interact with the teacher. According to the teachers, the class layout should be less deep and more spread out. This will also keep the students engaged with the teacher all the time as a teacher is able to establish eye contact with every student without moving from her place. Teacher needs to stand in the middle of the room to be able to deliver the lecture so that maximum individuals can hear it. With the present layout of seating arrangements in the class, it seems difficult for the teachers to deliver interactive lectures. This relates to one of the 'layout' aspects of workplace design which is categorised under the professional consideration aspects of workplace design in this research. The view above indicates that poor layout affects the perceived functional quality of the workplace and consequently teachers' ability to achieve organisational outcomes. This is just one of the various ways in which professional design considerations affect the perceived functional quality which then affects employees' ability to achieve organisational outcomes. This is evident from the responses of one of the teachers who commented that:

"*I cannot have debates in the class just because people are not able to hear the speaker. Now the only way is to call them one by one and make them stand in my place and speak. This is not debated as others have to just sit and listen*."

The layout was not the only professional design consideration which was found to affect perceived the functional quality of the workplace. Teachers also raised concerns regarding facilities and other aspects that may affect their ability to deliver high-quality content to students. For example one of the teachers commented:

> "*with no wifi, we cannot have good quality lessons. I cannot get information in real time*."

There were 23 other comments in which respondents talked about the problem with no wi-fi. One of the respondents sent a very detailed comment regarding this:

> "*There are only 6 computers in the library where we can access the Internet. How do they expect hundreds of students and teachers to use only six computers? Can you believe no Wi-Fi in the campus at this time? I have no choice but to prepare everything in advance and anything extra, no chance*."

According to the teachers having no Wi-Fi connectivity in the classrooms causes problems for both teachers and students. Teachers find it difficult to find and share content in real time. As a result, they need to rely solely on prepared slides which contain an only limited amount of information. E-learning is one of the concepts that many teachers have used while studying abroad and were quite impressed by how this is used in several UK and US universities to deliver interactive and real-time content. However, this is a major hurdle for them in Saudi female universities. As a result, the sessions are highly structured and this affects the quality of learning. Teachers who commented on this aspect suggested that having internet based resources is one of the most critical aspects of teaching some of the subjects because teachers do not wish to structure the program. Many of the respondents commented that this serious hampers their ability to provide western quality education in the university.

Most of the individuals who talked about accessibility not only talked about accessibility to information but they also talked about the accessibility of facilities such as libraries. The library buildings are often separated from the main university buildings. Many students and teachers do not go to the library because they have to take a long walk in the sun and hot stone floor. This makes library buildings inaccessible for the students and teachers and many of them do not utilise the library and the Wi-Fi facility within. Instead, students try to use their mobile phone's to create hotspots if they must access the

internet on their laptops. The problem is that the signals are too weak within the campus making it difficult to get good internet speed even with mobile phones.

Some of the teachers also talked about accessibility to the washrooms. As one of the teachers commented:

> "*Why do we have so few washrooms on this floor for hundreds of us. And it's at the end so we cannot use it unless we have plenty of time*."

In fact, this issue was raised by several individuals who believe that this often distracts them during the class. They cannot use the washrooms during the breaks because there is generally a long queue. This has a significant distracting effect on both teachers and students. This explains how poor layout and accessibility to the facility can lead to poor perceived functional quality of the workplace and consequently teachers' ability to achieve organisational goals.

Teachers also complained about the lack of common areas for interaction. According to the teachers, there are not sufficient facilities for interaction between the teachers as well as between teachers and students. For example, the image below shows one of the common areas with seating for just four individuals.

Figure 28: Common areas in one of the universities. Source: Self[3]

This image shows that there is little place for individuals, teachers and students, to sit down and interact. Even the offices have only two chairs for guests with no additional chairs available. The point that the researcher aims to raise here is not about chair and spaces but about the consideration that university education requires a lot of interaction between individuals. Constructivist believe that we construct our knowledge through interaction with others and elements of our environment. In this sense providing students and teachers space and options to interact will enhance the possibility for them to enhance their knowledge.

Some teachers also complained about of lot of dark spaces in the university, which makes them feel depressed and bored. As one of the teachers commented:

> "As such, we feel too stressed at work because there is nothing for us to use and enjoy for a change and then these dark corners make me so anxious and down."

[3]Image taken by the researcher with the permission of the university. Images are deliberately blurred to make it difficult to identify the university.

Figure 29: Dark alley in one of the universities. Source: Self[4]

Several teachers complained about aspects such as lighting ventilation etc. One teacher complained:

"*I have no window in my room. I feel like this is a prison cell*."

Another teacher commented:

"*I don't want to come to this room. It's so congested and no windows. Really*"

In fact, several of the respondents commented about no natural lights coming to their room. In response to the second and third question, most of the teachers suggested that

[4]Photo taken by the researcher with university permission. Images are deliberately blurred to make it difficult to identify the university.

they feel stressed in the rooms and have feelings of absenteeism. One of the teachers sent a detailed comment:

> "*Don't like going to my room and have nowhere else to go in the university. Outside too hot to go to the library. I am tired of this*."

Most of the teachers suggested that their rooms have not been designed adequately especially without any consideration that teachers may sometimes spend the whole day in their room considering that they might not have any lectures.For example, one of the teachers commented:

> "*I have no privacy and no space either. I have to share my space with 11 other people*."

The image below shows how the rooms have been laid out in one of the universities:

Figure 30: Shared staff rooms arrangements in one of the universities. Source: Self[5]

[5]Photograph taken by the researcher with the permission of the university. Images are deliberately blurred to make it difficult to identify the university.

This image clearly shows that there is not sufficient space for a person to relax. Furthermore, there is a lack of privacy. For example one of the respondents commented:

> "*How do I relax. I cannot just relax and close my eyes even for 5 minutes because there are 10 other people in the room watching me*."

However, this is not the issue in all the universities because some universities provide a separate room for each teacher. The problem in that is, however, lack of ventilation and natural lights as most of the staff rooms have no windows (please see figure below).

Figure 31: Staff rooms arrangements in one of the universities. Source: Self[6]

Some teachers expressed the need for some outdoor space where teachers can relax and unwind. One of the teachers commented:

[6]Photograph taken by the researcher with the permission of the university. Images are deliberately blurred to make it difficult to identify the university.

> "I wish there is a small patch of green where I can sit and relax. It's all stone's and concrete."

Another teacher expressed similar interests:

> "Its so boring. I cannot step out. It looks so..in the face. I want to go to a garden."

Many teachers suggested that having some green patch of the garden within the university campus will have a very calming and relieving impact on the teachers and students alike. As one teacher exemplified:

> "All we do is run from room to room. Where can we relax? Don't tell me to relax in a room. I need fresh air."

None of the three universities included in this study had an open green space for teachers to sit down and relax. Saudi Arabian environment is too hot for outdoor seating but there is a possibility of having green areas inside the university building for teachers to relax.

These comments exhibit some of the views of the teachers. This list is by no means exhaustive but it does represent a general view of what the teachers expressed in this comments. Next section looks at how these issues can be resolved through designing considerations from designers' point of view.

4.2 Qualitative data analysis

For the purpose of this research 11 semi-structured interviews were conducted with designers/ architects who have worked on projects involving designing of female universities. The table below gives the profile of the respondents:

Respondent ID	Total experience	Profile
R1	16	Have significant experience of designing universities and hospitals in Saudi Arabia.
R2	31	Chief designer. Led a team which was responsible for designing one of the largest female universities in Saudi Arabia.
R3	11	Interior designer. Have worked on teams designing universities in Qatar and Saudi Arabia.
R4	27	Have designed 3 female colleges in Riyadh and participated in designing two major Saudi universities.
R5	19	Have worked on three projects involving designing universities with one being an only female university.
R6	12	Information withheld on participant's request
R7	09	Worked on two renovation projects involving female universities in Saudi Arabia
R8	17	Led three renovation projects for female universities and participated in designing of two new campuses for female universities in Saudi Arabia.
R9	15	Worked on a renovation project for a female university in Saudi Arabia
R10	21	Information withheld on participant's request
R11	13	Information withheld on participant's request

Table 19: Profile of the designers interviewed

Workplace design factors

Professional factors

Respondents were first asked questions about what kind of design factors they consider when designing workplaces. One of the key aspects mentioned by the respondents is the purpose of the building. For example, R4 commented:

> *Designers work primarily with three things: Purpose, appearance and space. We make sure that the building can be used for the purpose that it is designed for which means it should solve its purpose. The appearance of the building should be pleasant. Aesthetics are quite critical. Third, space should be allocated adequately. Every building has a limited amount of space, you know it is limited by walls, floor and roof. Now within that space, we have to house everything; people, tools of the trade, facilities and everything. So managing space within the building is a aspect of any design.*

Several other respondents also mentioned keywords such as "purpose", "use", "usability" etc. all of which refer to the use of the building. When asked about what they meant by purpose respondent R4 elaborated:

> *The purpose of a building is who will use the building and for what purpose. I mean what they will do with the space, equipment and other facilities provided within the building. So if you talk about a hospital the purpose will be to treat patients. But then doctors are not the only people who will use the building. There will be a range of staff who will also use the building. There will also be patients and their relatives. So all in all, a building will be used by a number of occupants for slightly different purposes.*

When asked to elaborate in the context of a university respondent R9 provided the most detailed response:

> *Purpose of a university is to exchange knowledge and information among a community of professors and students. Students are learning from teachers and other students while the teachers also learn from other teachers and sometimes*

even students. So the purpose will not be teaching but knowledge and information exchange.

Based on the various views expressed by the respondents it was concluded that facilitation of knowledge exchange among the community comprising of teachers and students is the primary purpose of the university. In this respect, the job of the teachers is to facilitate the exchange of knowledge as well as act as a source of knowledge for the students. For this to happen teachers need to be able to both acquire knowledge and information as well as share it with other occupants of their workplace. This means that professional considerations of the workplace will involve facilitating knowledge exchange among the occupants of the workplace. According to R6

Now profession is also very important. Because every profession requires certain things. Think of a hospital. We need to make sure that everything is properly sealed and there is no noise and there is no contamination. So hospital will need rooms which are properly sealed against air and noise. Lighting is key and safety of equipment is key so we have to make sure that the electrical wiring is done properly and there are easy points to check of something goes wrong like a fuse blows off. ...Sorry, you wanted examples from the university. Okay. I will give example from the ...university that we designed. In academics, we know that books an stationary is critical so we give a lot of space for that. Also, teachers need to read a lot- either on books or on laptops. So having plenty of natural light is important, other wise they will get a headache by reading.....Also, there are different teachers teaching different subjects. So we want to make sure that the design is suitable for all the kind of subjects. The old classrooms were like rectangles. SO there were dark spots both for the teachers and the students. We designed semi-circular classrooms where teachers could have eye contact with each and every student. It is important...Also, we wanted to make sure that the rooms are equipped with all possibilities, not only for today but for future also. So we had electrical wiring for projectors and other gadgets even though they are not using it right now just in case they need it for future. There were hard negotiations for this but in the end they understood.

In terms of professional design considerations, almost all of the respondents suggested that one of the key considerations in workplaces is that of space. Space allocation is a key design consideration according to the respondents. For example one of the chief designers (R2) who led the team which designed one of the largest female universities in Saudi Arabia commented:

> *I think each and every aspect of the design matters but the most critical if you ask me is the space. Most of the people get affected by how open or congested the workplace is around them. It affects their movement and at the same time, it affects their ability to focus. So we try to make sure that the space around them is well organised.*

Managing space within the building so it supports work processes as well as remains convenient for its occupants is a critical aspect for design consideration. What is also interesting in the responses was the reference to the purpose of the workspace which referred to the professional considerations. Many designers suggested that purpose of the building is one of the key considerations that affect their design decisions. This indicates that professional design considerations i.e. design considerations aimed at the profession of the occupant is a critical design consideration for the designers. This view was supported by all of the respondents as they agreed that professional consideration is the most critical consideration when designing any workplace.

Almost all of the respondents directly or indirectly supported the view that profession of the occupants is a critical design consideration. When asked specifically about how they take professional aspects into consideration when designing a university, respondents provided several different examples.

Similar views were expressed by R9 who commented:

> *Every profession involves keeping certain stuff- for example, a lawyer or teacher will have many books so we need shelf space and this should not be unreachable. In classroom teacher will want to be in a position where he can maintain eye contact with every student so instead of square shaped classrooms, we will make semi-circular shaped.*

The respondents thus suggested that there is a standard format of features that all universities have and the same features are incorporated in the designs that they have prepared. This standardisation is primarily driven by the design considerations regarding the professional of the occupant and nature of their work. As R1 commented:

> *You will never find heavy machinery workshops with shiny marble floors or tiles. Why because it can cause accidents. Similarly, for universities, we have a standard criteria- what we should have and what not. Whatever is absolutely necessary is done and what is not as necessary is decided based on the requirements given by the client.*

R10 commented:

> *When you design any building your key concern is the purpose of its use. So if I am designing a hospital I have to make sure of the requirements for the hospital. And of course, the client will tell me how many beds and what facilities they need. Now things are similar in universities. We know that it will be used by teachers and students and then we go back to see what they might require. On top, we get a few requirements from the client. At the end of the day functionality, I mean the utility of the place is the key.*

R2 commented:

> *You need to be aware of who is going to use the building and for what purpose.University is for teaching and study so that becomes the purpose. Now there is no purpose to have an entertainment room in the university but a library is a must. You need comfortable furniture because students and teachers are expected to sit for a long period of time. Also, there should be no noise so sound proofing is critical. All these aspects are aimed at ensuring that teachers can teach without disturbance and students can study without disturbance.*

R5 commented:

> *It is important because for every building it is important to have clear purpose. For example, in a home you will always find bedroom, bathroom and kitchen.*

You will not see people cooking in their bedroom. Same way in university there are a range of functionalities. For example, you need a library and it is essential that it is soundproofed as much as possible. Then you also have other aspects such as library and staff room. So there are many things which you will see in each university building. The same we try to build in every university.

According to the respondents, professional aspect of the occupants is a significant aspect considered. However, they also agreed that rather than being innovative they tend to look at existing models of universities for cues regarding functional aspects of the buildings. This somewhat eases the burden on the designers as they can standardise what is required and make changes based on specifications such as capacity and nature of studies. However, one of the designers commented:

If you see the universities you will see most of them are alike apart from their appearance. But I have seen some wonderful universities in UK and US and many of them are very unique. They tend to build a sense of community among students and the whole design and facilities and all are designed to help the students integrate into the university community. This is what I find lacking in Saudi universities. It is as if we treat these as buildings and not communal places.

This was one of the most notable comments amongst many expressed by different respondents as it highlighted that functionality in Saudi universities is based on a generic university model which may not be good quality in terms of supporting interaction among occupants. This interaction is essential for knowledge and information exchange to take place. Respondents did mention some of the aspects of the university that they have incorporated in the design but the aspects discussed were mostly generic aspects. However, as some responses indicated there is a possibility of a significant level of improvement in terms of improving the functional aspects of Saudi universities by improving the focus on nature of the profession. As R4 commented

I would say that currently there is lot of scope of improvement. What we have is what is common model in terms of design. But you know your university and I have seen many too. We know that universities are unique in what they provide to

the teachers and students. So that is why we say this university better than other. For example, some universities have excellent research facilities. This does not mean books only. It means the whole university is designed to motivate and facilitate researchers. So yes, I think we can change a lot of things and look at each universities as unique, going into finer details and see what can be done to improve its usability for the teachers and students. The problem lies somewhere else. Most clients do not like experimenting and they wish to stick to the traditional model. Especially in our society where everyone is too scared to cross the cultural line.

This model clearly indicates that even designers feel that the current models are not innovative and may not be best suited for achieving the primary purpose of the university. In terms of practical suggestions R5 commented:

You can go into specifics and have a specific suggestion for everything. Let's take facilities for example. In the three universities that we designed, we do not have debate rooms or rooms for group discussions. If you realise, group discussion is generally round table. What we had is generally rooms where there is one speaker and rest audience. But that is what we were specifically asked to do. Lack of space or whatever may be the reason but we have to understand one thing that if we do not provide space for debate, we are essentially curbing the possibility of debate which I think will affect the learning of students.

Respondents who spoke about how professional aspects could be considered suggested that designers should focus on the rapidly changing nature of interaction between the occupants as well as changing nature of sources of information. For example, R7 commented:

If you look at most progressive universities they are very modern. Now modernism in universities is not only about having a computer room. It should show in every aspect of the building so much so that it becomes a part of the lives of teachers and students. This is essential for them to adapt to technology. You will see this in any Qatari universities. I have personally worked on those

projects. But in Saudi we have mainly adopted a restrictive approach in designing. We tend to reject modern design a westernised. In that we reject what is good and what is bad both. We need to accept modernisation of our university designs, make it more technology focused.

R4 commented:

I have seen a lot of change in how universities are designed in Saudi Arabia. I have worked on 3 different projects for designing female universities and I have seen the difference in specifications. Our universities are much more westernised now but yes female universities are still very traditional. I think it is because of the nature of subjects that girls study. In Saudi, in past women were mainly confined to subjects which help them in fulfilling roles which were considered suitable for women. Subjects such as science and maths are not common in females. These are modern subjects and since these are not so common in women that's why you do not see any modern universities for women.

R10 also gave specific examples as to how Saudi university designs are not modern in nature:

when you see Saudi universities what you will see will be stone's and bricks. You will not see glass walls. Glass based designs represent modern designs. They improve visibility and allow better space management. Also people working in such buildings tend to think differently as compared to those in brick and mortar buildings. I am not saying that they are completely different but I think with time they develop different personalities. People in glass buildings will tend to be open and those in rock buildings will tend to be closed personalities. It may be my view but I think we need to at least experiment and see if this is the case.

Thus according to the respondents, the current designs are a bit restrictive in nature and it may restrict the creative thinking ability of teachers and students. This definitely has a negative impact on the quality of teaching and quality of education of the students.

According to the respondents, the designs should promote openness and creativity and for this, it is essential to have features like visibility, natural light and air and also ability to move without restrictions. Although these specific suggestions are not proven in practice especially in the context of Saudi all-female universities but the suggestions definitely advocate looking at more modernistic designs to reflect the technology-based nature of teaching today. They suggest that designs should be technology driven rather than the other way round.

Cultural considerations

Next, the respondents were asked about cultural considerations. Respondents suggested that culture has a strong influence on the designs in Saudi Arabian universities. According to R3:

> *See culture is critical because it affects the way we think. So we see if the organisation is multicultural or mono-cultural. Mono-cultural makes it difficult. In multicultural you can go culture neutral approach. In mono-cultural you need to be very specific about each and every aspect.*

R3 gave an example of how culture affects different design aspects including space management as example:

> *in Saudi business we will design so that there is interaction between people because Saudi females like to interact with each other. But this is not for everything. Not that we have one room where everyone is sitting. I remember two incidents where the bosses clearly asked us that they need a clear wall between themselves and staff. They were not comfortable with their staff being able to look at them all the time. So what they wanted is design which allowed them to keep eye on the employees but so that the employees cannot see them unless they are called in the office.*

R2 also provided some examples:

> *I can give you lots of examples. For example, think many women in Saudi are bit liberal minded while many others may be very conservative. So we make sure that*

all cultural traditions can be followed. There should be prayer room large enough. There should be minimum visibility from outside so people outside cannot see inside. At the same time workers inside should be able to see outside. So culture I would say is one of the most critical consideration especially if we are designing something for Saudi Arabia. You know how particular they are. In some cases we even get our design approved by individuals who have complete knowledge of Sharia laws. Aesthetics are important but the most critical is the religious factors and then cultural factors- well the two may be linked but not always.

Almost all respondents agreed that culture has a very significant influence on workplace design in Saudi Arabia. According to R11

You have to be culturally very sensitive. There is a thin line there. Interaction is important but Saudi women like to interact when they want. So we need both privacy and ability to interact. The place is designed so that no one can see inside anyone's room unless they intend to. We wanted the angles of the doors to be such that anyone sitting side is in clearly visible unless someone steps into the room which is basically someone wants to have some sort of interaction. Also we ensured that there are some sitting areas for people to sit and discuss. This was to make sure people are not standing when they are chatting as this may cause obstruction for others.

Saudi Arabian culture is driven by Shariah principles and this is evident in designing also. According to R8:

In case of Saudi Arabia knowledge of Sharia principles is very critical because we cannot make a mistake of designing anything which violates Sharia principles. So we seek permissions for designs when we are not sure. We get approval on colours, lights, windows, doors, facilities, furniture everything. Just to be on the safe side. I remember one time, when they objected to pink colour in common areas and suggested that we have either white or green colour. So we ended up

making everything white. Now it is much better that we take their approval at the beginning rather than later because it will cost a lot to change.

The problem is that whenever any aspect of design is considered against Shariah principles, it is most likely to be ruled out. In Saudi Arabian culture Shariah principles are supreme and even those aspects which may be practically useful but are against Shariah principles are ruled out. As R9 commented:

The problem is that some people want it and some do not. The issue with Saudi Arabia is we have to pay more attention to what people do not want because culture and religion are the most supreme things and we do not want to include something which will offend people. You know how it is. Now in the universities they teach Islamic studies and in all such courses the people teaching are very religious. They find lot of things, which are against Sharia. Can you imagine we have to get even the paintings and other artefacts approved by a sharia committee to make sure that it is not against the religion.

Culture affects every aspect of workplace design in Saudi Arabia. For example, culture affects the choice of facilities at workplaces as was suggested by R1:

There are lot of cultural conflicts like in a project that we did around few years ago, we could not have recreational spaces which will make the design look like westernised. So we had to choose everything, which is strictly according to Sharia principles, and nothing westernised. Cafe was something we discussed a lot. We wanted something like Starbucks in the university- big cafe where teachers can sit and have nice tea, coffee and snacks. But it was refused. See many teachers and students in the university are conservative and no one wanted to set up something which the people might object to. I have seen people even complaining about internet and music is definitely a no. Also a cafe for some teachers and students is western. So we ended up setting a small coffee shop. Anyone who wants coffee can buy coffee and drink it at some other place. We were not allowed to set up a recreation place as such.

According to the respondents, culture has a strong influence on the education system in Saudi Arabia in general and this also reflects in the design of Saudi Arabian universities. According to R2:

> *Saudi Arabian education system is still evolving and the current system has a very strong influence of Islamic culture. The problem is excessive focus on culture which makes it difficult to design a university which can be modern as well as based on culture.*

Very similar views were expressed by R4 who commented that:

> *There is a kind of conflict here. On one hand Saudi government is looking to modernise the education system and at the same time there is reluctance to part with the strong Islamic culture that we have. If you look at Qatar, there is a strong focus on education and modernisation. In fact government policies are driven by these. So if you look at their universities, the new one's, they have very modernistic designs. I cant say the same about Saudi Arabia. In Saudi we have very strong focus on culture in everything we do including our education. Now Islamic culture is very old and so are many of the beliefs. These come from times when there were no computers, no technology nothing. This simply does not fit in modern system.*

According to the respondents, cultural considerations is actually a barrier in designing modern universities. Respondents provided some unique insights into this. According to R5:

> *The problem is that the designs are generally provided by people in government who are strong followers of Islamic religion. So their entire focus is on Islamic culture. I have personally witnessed cases in which the sponsors asked to design universities which will specifically reflect our Islamic heritage. So we end up designing buildings which look like Islamic palaces rather than universities. Well I don't have any issue sin that but the problem is that the entire focus is on external appearance of the building while little attention is paid to internal environment. If you follow Islamic architecture closely you will see that it follows*

geometric shapes and repetitive art. Also the interior design are heavily focused on Islamic traditions. The problem is that it shows that history has more weightage over the future. It has a strong impact on how we think and behave even in terms of acquiring education.

While in many respects Islamic traditions are followed in designs, in some critical aspects these are missing. According to R10:

If you look at many universities, you will find there are no areas for socialisation. This is a problem because teachers normally do not get to interact with other teachers. This socialisation is key in our culture but for some reason this has not been addressed in university designs. From my personal experience this is because of rigid views of the sponsors who quickly refuse including such areas in designs as they consider these non-essential and also against the culture.

As per the respondents, the narrow view of the culture often affects the quality of design. In terms of design, most of the cultural focus is on architectural aspects but very little on interior designing aspects. Saudi culture is quite strong and it affects the way in which people interact and exchange information. In Saudi Arabia's collectivist society social interaction among individuals is a key aspect of their life. As per the comments of the respondents, the sponsors often adopt a narrow view of the Saudi culture thereby incorporating it only in architecture but not considering the internal environmental aspects which affect the behaviour of the people.

Respondents were specifically asked whether they take a culture of the occupants into consideration when designing university buildings. Some respondents indicated that they do provide some considerations to cultural aspects but not as much. For example, R9 commented:

Culture is paid some consideration especially because in Saudi Arabia culture is related to religion. For example, we cannot have paintings and idols in the buildings and buildings are generally dome shaped. But that is about all the buildings and not only about university. For university we do not have any specific design considerations in relation to culture. You must know that there are

teachers and students from various different cultures so catering to such a diverse community is best done by making the building culturally neutral as much as possible.

Other respondents also commented that cultural factors are considered but not to a great extent. For example, R7 commented:

Cultural factors are important but I think we consider national culture. So if you see the buildings are certain shape. But I don't know how you mean culture. For example, we don't have statues and all. But generally for an institution like university we do not focus on culture. We focus more on the usage.

R8 also suggested that universities are multicultural and aimed at providing a wide range of courses and hence the attempt is to make the buildings and its facilities standard rather than making these culturally focused. All the respondents, however, agreed that the external shapes of the buildings are designed to reflect the national Islamic culture but the internal workspace of the buildings are designed not culturally oriented but are rather focused on the profession of the occupants and the usage of the workspace. However, the respondents did agree that there are bare minimum cultural aspects that they have to be aware of; for example, whatever is against principles of Islam are avoided at every cost.

There seem to be quite contradictory themes emerging about the culture from the views of the respondents. The contradiction could be because of the different projects that the designs have worked on. Broadly speaking culture is considered an absolute essential for external architecture of the building. Internally space is designed so as to provide privacy to the teachers. However, Saudi Arabia society is a collectivist society which values teamwork. This means socialisation is quite critical and this can be best achieved by adopting open designs rather than the currently closed designs. However, the high power distance aspect of Saudi culture warrants some degree of separation between the teachers and the students. For example, R1 commented:

We know that Saudi teachers like privacy. Apart from classrooms they like not to interact too much with the students because they think they cannot be themselves. This is one problem because if you see most schools in western countries, they are

quite open designed to increase interaction between teachers and students. But we know this is not UK so we have to change things accordingly.

This indicates that there is a need for separate communal areas for teachers and students. However, in the three universities included as case studies in this research researcher did not find any such communal areas. Communal areas are the areas, which the occupants can use for recreational purposes. The only communal areas provided were the areas in the lounge/ galleries where some sofas were placed. However, these areas were mostly vacant as these were not properly ventilated and sometimes no air conditioners were installed in these areas. Based on researcher's observations it is fair to say that communal area did not exist in any of the three universities that the researcher visited. This was also confirmed by R4 who commented:

Our treatment of universities is more like an office. People come to teach, they teach and go back home. Students come to learn, they learn and go back home. I think we are still lagging in understand how modern education works.

Modern education is based not on instruction but rather on principles of constructivism. Individuals learn through their interaction with their society, surroundings, as well as through their experiences. This is where the current designs are lacking because these focus mainly on the instructional model of teaching which used to exist in past times where students were passive learners.

Respondent R10 provided an interesting view:

We know that teachers teach and students learn. But we have not yet looked into the learning of the teacher itself. Teachers interact with other teachers and learn about new things. This helps them expand their own knowledge which helps them in teaching better. So if we do not allow them a place to socialise how will teachers interact with other teachers and how will they expand their knowledge?

This comment indicated that cultural understandings can have a direct impact on the quality of output that the teachers produce. Teachers who are able to interact and socialise with other teachers at the workplace are likely to have a broader set of information and knowledge to share with the students.

R4 had a different view as he suggested that culture, profession and gender have a cumulative impact on workplace design:

> *You are talking about culture, profession and gender. The thing is that these factors do not affect workplace design in isolation. I mean to say it is not easy to separately verify their impact on workplace designs. For example, if the culture is more about people working in isolation then we will think about somewhat closed spaces but if it is like a creative business then we try to keep it open. Now culturally we will see if people will like personalisation so we give them furniture which can be adjusted according to their needs. Nothing will be fixed. If people like to experiment then we give them plenty to experiment with and make it their own. See no one will work in a company forever and new people will come and use the same space. We do not want that the next person comes and he doesn't like the design but is left with no choice. So we design it so that when person leaves and other one comes he can redesign it according to his choice.....Also in many cultures people get worried and concerned easily so we try to eliminate anything which could be even slightly threatening for them. For example, wires can be threatening so we make sure that everything is concealed. Similarly, sharp edges or anything sharp can be threatening so we remove that. Things stored at heights can fall and injure people so we ensure that the space is given at lower levels and not high. Also storage at high levels block light so that is not good. But then if you give too much space at the bottom there will be less space to walk. So everything has to be designed very carefully. Even glass can be threatening for some people so we remove as much as possible and make sure that the person feels safe and is not worried at all being in that space.....Once someone fell on ceramic tiled floor and had a brain haemorrhage. So do we remove tiles completely. But tiles look nice and are easy to maintain. So we imported anti skidding tiles which were not available in Saudi at that time. So we do think about all these aspects.*

It is widely noticed in the literature that cultural aspects play a critical role in how we behave and how we learn. Thus, detaching culture from workplace design is likely to be counterproductive. At the same time, there are certain aspects in which Saudi culture is in conflict with modern education. Furthermore, no attempts are made by designers to ease

out any conflicts that may exist in the need to design for modern education and culture in most cases culture takes the precedence. As R10 commented:

> *I think the best way is to observe the behaviour of the teachers and see how they interact with their environment and with others. We have taken very unscientific approach towards development of workplaces. We consider these as mere buildings who do not have much impact on the performance of individuals. As a result we have ignored important aspects such as impact of these designs on psyche of individuals. If only we try and understand this we will be able to design workplaces for people to get motivated from. We all get happy and motivated at certain places and find some other places really gloomy and depressing. It is not impossible to design such workplaces but we need to first find out what people need to be able to perform well and how the workplace can help them in that.*

Thus the respondents highlighted several ways in which culture can affect how employee perceive their workplace and consequently how workplace design affects their productivity.

Gender considerations

The third aspect discussed in this research was the gender considerations in workplace design. Gender plays a specific role in how individuals interact with their workplace. In this respect R2 commented:

> *I think we need to know more about the occupants and the way they go about things in their everyday work life. The problem is that we are not allowed to observe due to culture. But even if someone observes she will not know what is going on in the person's mind. So this is a bit complex. The only way we can do is through experiments. But this is not easy. Above all it is to be considered that Saudi females are different from western females and they have different requirements. This is somehow remained a challenge because of the lack of professionalism. Designers talk to sponsors but no one talks to the teachers. I agree with you that the universities can be better designed for probably even lesser money if we talk to the teachers*.

Similarly, R4 commented:

> *There is no doubt that males and females have different expectations for their workplace. They want different things as they have different physical and emotional needs. You will see this eve in the house where males spend most of the time in the living room while females spend most of the time in other areas such as kitchen, bedroom. This is how houses are designed where most of the things that males need are located in one area and most of the things that females need are located in another. This is the reason why we need to think about this in designing workspaces.*

There is ample evidence from real life that the preference of men and women regarding their environment can vary significantly. According to R10:

> *In real life if you see men and women they behave differently and exhibit different needs and expectations. There are some clear differences in what men and women prefer and need and this is evident in everything that they do. This is true for their workplace also where men and women would need different things and features. For example, I would say a place to socialise is quite useful in case of women but men do not need a place to socialise like that. Men are good at socialising in smaller groups wherever they can. But for men a place to unwind is quite important such as smoking areas. So all in all there is difference in what men and women need and expect.*

In terms of difference, in needs of males and females, R9 provided an example of how it may affect workplace design:

> *Mood is one of the issues with females. They can experience mood swings more often than men. So we have to give greater degree of customisability to them so they can alter their surroundings as per their mood. For example, men may either like bright light or may not like it but if they like it they like it- always and if they don't, they don't. With women it is more delicate. They may like it sometime and may not like it sometime, or they may like a bit of it but not too much. The variation is too much. So we look at how we can give them better control of light, air , space, colour everything. We want them to be comfortable.*

R5 also provided similar example:

> *Women often have back problems so bending down is a problem. So we try to make sure that storage is at a level which is not too high or too low for them. Even when it is low, the design could be such that they will need not bend down. Also women often find difficult at work on high tables so we can have tables that are adjustable to the height or we can have tables which will suit a person between 5-6 feet of height. But then some women may be even shorter than that. So yes, complications are there but we think about each and every aspect.*

According to R3

> *Okay think about this. What kind of footwear women will generally wear. These are often pointed at bottom so less surface area in contact with the floor. Also their soles are generally hard. Both these things mean there is less friction between the show sole and floor surface. This means that floor should be such that it has anti skidding properties. Also the shoes make a lot of noise, which can disturb people. If you in operation theatre performing a complex operation and someone walks past with loud tic tac tic tac then the surgeon can easily loose concentration. It's not easy to manage these things but we must manage these. So for gender we see the characteristics of the gender, what they do what they wear etc.*

It was clear from the responses that respondents understood the difference in needs and expectations of the male and female occupants of workplace. Respondents were then asked how do they take gender factors into consideration when designing universities for females. According to R4:

> *Designing something focused on gender requires engagement with that particular gender. So if I want to design something for women I need to engage with women and try to understand what they would want or expect. The problem is that I am a male and I am not allowed to interact with women. Even in our designer team we have no women. The problem is quite common in this industry and that is one of*

the reasons why you will see that not much attention is being paid to gender based designing.

R9 commented:

It is not quite common in Saudi Arabia. You know that we are a male dominated society so all professional workspaces are designed as per men. They do not think about women because women professionalism itself is not that common in Saudi Arabia. So there is no culture of women workplaces. The problem is that no one knows better about what women want and need than women themselves. This is the problem. Unless we have women who can represent women in designing workspaces we will not be able to design workplaces for women.

R11 commented:

Gender issue is quite a sensitive issue in Saudi. You must have noticed this in every of society. If you go somewhere you will see that everything is designed for men. I mean not homes. There you can see the designs for women but it is not possible to design workspaces for women in Saudi Arabia. I mean we try to design workspaces for women but we know that it is not perfect. We try to draw some knowledge from what we know about Saudi women and culture but still I would say that it is not perfect. We have tried to replicate some aspects in foreign universities but then the cultural issues become a problem. Overall we are trying but we are not there yet.

Even for the workspaces where women work the work environment is generally male dominated and hence little consideration is provided to women employees' needs and requirements. This was highlighted as one key barrier by R5 who commented that:

In Saudi Arabia, there are very few workspaces that are women only. I know you are talking about female only universities but think in general, how many workplaces have you seen which are women only. The thing is that we have a woman mixed workplaces at best and that too also are dominated by males. So you will see most top managers are still males. Take, for example, hospitals. Most doctors are males and females are mostly in jobs like nursing. There are no all-female hospitals. The problem is that because of this there are no all-female workplaces and hence no culture of considering all-female

workspaces. In western countries also you will not see any female only workspaces. So overall expecting a female only workspace itself is not a conceivable idea.

Thus overall the respondents indicated that:

- Firstly, gender considerations are important but not yet accommodated in workplaces designs in Saudi Arabia as women participation in workplaces is quite limited.

- Secondly, the best way to consider gender in designs is to include women in designing teams which is an uncommon practice in Saudi Arabia. Women focused workspaces can also be designed by observing women to identify their needs and requirements. This is also not possible in Saudi Arabia due to cultural issues.

Workspace designs and employee performance

Respondents were then generally asked about how they believe that workplace design affect the performance of employees. Respondents were asked to provide some examples in general as well as for female universities if they had any. The table below shows the different responses provided by each one of the respondent:

Respondent	Comment
R1	I think there is an absolute relationship between how we design workplace and how it affects employees. A comfortable working environment make people enjoy their work and once they enjoy the work they are more productive.
R2	Employees need to be satisfied with their workplace. If they are not satisfied they will not put their heart and soul in work and unless they put in their heart and soul they cannot put in their best efforts.
R3	This is not even a question. I have one question for you- you find me one person who says that workplace design does not affect employee's performance. This is like a fact which no one can deny.
R4	I would say that workplace itself contributes to employee productivity. How do you think the teacher can teach if say there is not enough light in the room or the room is not properly ventilated. When you are in a space, which is not physically comfortable for you then your focus is not on work but rather on making yourself physically comfortable. This is natural human reaction.
R5	Oh yes. Without doubt. It is eve more critical in professions where it is all about the intellect and less about labour. Even in labour such as in construction industry and mechanical manufacturing industries you will see that physical comfort of the employee is very important. Now in knowledge based professions such as teaching, IT or medical profession you will need a different kind of environment, which can be peaceful and allow their minds to think.
R6	There is definitely a link. We think according to our environment. If you are sitting in a noisy place you can probably carve a statue but you cannot perform an operation. The workspaces are designed for every profession and people get used to their environment. Think of a doctor- he knows what to expect in a hospital environment. There is a great deal of standardisation. So people work in harmony with the environment. You can certainly be more creative and make the workplace more comfortable and enjoyable but you cannot take away things which they consider necessary.

R7	I know most people will say that it does but I would say the contrary. I think it does not affect to a great extent. Now when I say this I have to add some clarification. I think there is a bare minimum acceptable standard of workplace which has to be met. Beyond that it is other organisational factors such as salary, culture etc. which make a more significant impact on performance. Now for workplace design I would say that at more than the bare minimum it will not have any great impact. Less than bare minimum it will have negative impact. So depending on whether you can design something to minimum acceptable level.
R8	It will and it should. It is not only about workplace but about every place. It affects us. Doesn't it? We get affected by our surroundings. We go to nice scenic places to enjoy but for shopping we want to go to the busiest shopping mall. Each environment stimulates our mind for a specific purpose. Workplace is no different.
R9	Workplace design will definitely affect employee performance because it will affect how they feel. This if you are talking that they are physically comfortable. Physical aspect is an absolute must. Health and safety of primary consideration. But even apart from that workplace need to be designed to help employees.
R10	Definitely. Workplace is part of the package that the company provides the employee in order to motivate the employee to work. This is the reason why some companies have better performance than others.
R11	If you ask me the three most significant factors which affect employee performance, I would say one of these is definitely workplace design. In design I would include both physical and environmental factors. Depending on the nature of work you have to focus on physical or environmental aspects. If you go to Google's office you will see focus on environmental factors but if you go to Foxconn's factory the focus is mainly on physical aspects.

5 Data discussion

5.1 General discussion

This research aimed to find out how workplace design consideration affects employee productivity. In this context, this research first identified how cultural, professional and gender consideration at the time of designing the workplace affects the functional, psychological and social wellbeing of the employees and how these affect employee's ability to achieve their personal and organisational objectives. Employee productivity is evaluated on basis of employee outcomes and organisational outcomes.

While there are other factors that may also need to be considered at the time of designing workplaces this research was focused on academics teaching at Saudi all-female universities. The sample was quite distinct in terms of uniformity in nature of the profession, gender and culture of the employees. Hence these three were considered relevant in this research. Some researchers have even argued about considering workplace design not only from the perspective of the architects but also from the organisational point of view, for example, looking at how the organisation is structured. However, this research was conducted from an architect point of view and was focused on physical designing of the workspace and how it affects employee's productivity.

This research confirms that employee productivity is significantly affected by workplace design considerations. Most of the research conducted to investigate the relationship between workplace design and employee productivity has agreed that workplace design has a significant impact on the employee productivity (Freivalds 2014). It affects employees in multiple ways such as increasing motivation, reducing stress (Haapakangas et al. 2008) and reducing feelings of anxiety and absenteeism (Pejtersen et al. 2011). This research confirms the findings of Milczarek et al. (2009) that workplace designs should be optimised to facilitate employee productivity and that poorly designed workplaces can have a negative impact on employees' productivity. Indeed as highlighted by Åsberg et al. (2002) poorly designed workplaces lead to a rise in absenteeism among employees. People working in fields such as education have mostly completed their PhD and are middle aged and above. Such ageing population is even more susceptible to

negativefeeling such as absenteeism due to poorly designed workplaces as was highlighted by (Westerlund et al., 2009).

The quantitative research included a questionnaire survey which could be logically looked at as comprising of two part. The first part investigated the impact of three kinds of design considerations (i.e. gender, cultural and professional) on perceived quality of workplace design (i.e. functional, social and psychological qualities of the workplace). The second part of the questionnaire looked at the impact of perceived quality of workplace designs on two kinds of outcomes, employee and organisational outcomes. These variables have been defined in detail at the end of the literature review chapter.

First regression model in research finds that cultural and gender design considerations do not affect the perceived functional quality of workplace while professional design consideration does affect the functional quality of the workplace. Designing workplaces which support work processes and which are designed keeping in mind the nature of work is crucial to improving the functional quality of the workplace. Functional quality of workplace directly affects employees' ability to perform their tasks. This indicates that workplaces can work as facilitators or inhibitors of employees' tasks and have a direct bearing on the quality of work. This has been well established in almost all past research which suggests that considering the nature of work while designing workplaces is likely to have a significant impact on the employees' ability to complete their tasks. For example, teachers require specific environmental attributes such as noise free environment to be able to focus on their work. Similarly, in construction sector ability to move freely is critical for workers to be able to perform their tasks. Open plan Vs closed designed workplace is a key consideration in this respect. Within last few years, there has been increased interest in designing open plan workplaces. However, these are suitable only where individuals need to interact with each other or when the mental stress of employees could be too much due to monotonous work. But in professions where employees require focus and attention, it is essential to have some degree of segregation so that employees are able to focus on their work. Attention needs to be paid to work processes.

Cultural and gender issues may affect personal aspects of workplace quality but this research finds that these do not affect the functional quality of workplace design. This is confirmed by the second regression model which suggested that gender and cultural considerations during workplace designing have a positive and significant impact on

perceived psychological quality of workplace while professional design considerations do not have any statistically significant relationship with perceived functional quality of the workplace. Factors such as perception of controllability and privacy are derived from cultural preferences and in the case of Saudi Arabia also gender aspects because there is a high degree of gender segregation. Gender issues are quite critical in Saudi culture and as such researcher considered whether gender issues should be considered under cultural actors itself. However, on close inspection of past research, it was realised that females may have different workplace requirements independent of the cultural issues. For example, females have different body structure and different physical requirements which are not driven by any culture but purely because of gender. For this reason, gender issues were considered separately from cultural considerations in this research. Social quality here refers to the extent to which people are able to interact with each other for various purposes. Since people interact for both professional and personal purposes, it is not surprising all three design consideration were found to have a statistically significant impact on perceived social quality of the workplace. In sum, it can be argued that all three kinds of design considerations are critical for improving the overall perceived quality of the workplace.

However, just improving perceived quality of workplace is not enough to establish that it will have a positive and significant impact on the productivity of the employees. The productivity of the employees in this research is determined based on employee and organisational outcomes. Most of past research consider productivity as a single variable but in this research, researcher decided to consider productivity as comprising of two different set of outcomes- one that benefits the organisation and other than benefits the employees themselves.

Regression model number four reveals that all three kinds of design considerations have a statistically significant impact on employee outcomes. This research confirms that improving the functional, psychological and social quality of workplace is likely to improve employee outcomes. Regression model five indicates that only functional quality of workplace affects organisational outcomes while the social and psychological quality of workplace has no statistically significant impact on organisational outcomes. Form regression model one it is clear that functional quality of workplace is affected solely by professional design consideration. These findings are somewhat surprising because these indicate that firms just need to focus on professional aspects of workplace

design but pay no attention to gender and cultural issues. In order to ensure that these findings are true, another regression model was tested to see if employee outcomes would have an impact on organisational outcomes. The findings of regression model number six indicate that employee outcomes have a statistically significant impact on organisational outcomes. In other words, while the psychological and social quality of workplace may not have a direct impact on organisational outcomes but these do affect organisational outcomes through employee outcomes.

In conclusion, the six regression model indicate that it is essential to pay due attention to gender, cultural and professional design considerations in order to improve the functional, psychological and social quality of workplace which in turn are likely to boost employee and organisational outcomes.

5.2 Considering occupants' professional in workplace design

In terms of professional considerations, the interviewees suggested looking at three aspects: purpose, appearance and space management. First and foremost thing that needs to be considered is the purpose of the workplace i.e. the nature of the work. Every workplace has a specific purpose. In the case of educational institutions, the purpose is knowledge exchange between the occupants of the building primarily from teachers to students. According to the findings of this research universities should be designed not for the purpose of teaching but for the purpose of knowledge exchange. Universities are Universities in which teachers engage with mature students in a process of knowledge exchange. It is not a conventional teaching environment in which teachers can claim to know all. As per the respondents, teachers in universities learn not only from other teachers but also students and at the same time students also learn from teachers as well as their peers.

Knowledge generation is a complex process which requires mentally stimulating environment. All aspects of the building should be focused on creating an environment whereby learners (both students and teachers alike) can engage to jointly convert the cumulative information into knowledge for the student community as a whole. The environment in this respect plays the role of a facilitator of knowledge exchange and

hence the university should be designed for the purpose of facilitating knowledge exchange.

Space management is quite critical in this regard. Teaching in Universities is different from that in lower education institutions in that Universities are more focused on the development of independent learning. This requires individuals to be creative and independent. As per the respondents of this research, this independence should also reflect on workplace designing i.e. the occupants of the building should be given the flexibility to design their workspace. This was something that was evident in the responses submitted by both the designers and the teachers. More fixed attributes make it difficult for the occupants to change the workspace arrangement as per their needs. However, respondents indicated that most of the Saudi universities are fixed designed i.e. there is little possibility for the occupants to move the furniture or other aspects to suit their needs. In such an arrangement occupants are expected to adjust as per the workplace rather than the other way round. This is considered to be one of the negative aspects of workplace designs in Saudi all-female universities.

Respondents also argued that most Saudi all-female universities are simply drawn based on standard models adopted from other universities without any specific scientific thinking going into this. This research supports the need for adopting a more scientific approach towards designing of all-female universities in Saudi Arabia. For example, square shaped classrooms make it difficult for the teacher to develop eye contact with all the students and also for the students to engage with each other. In larger classrooms, it is even more difficult for the teacher to address all the students at the same time. In most modern western universities this problem is resolved by designing classrooms in a semi-circular arrangement. On the other hand, most Saudi all-female universities continue to have square or rectangular shaped classrooms. This poses several problems for the teachers. For example, it makes it difficult for the teachers to develop eye contact with all the students. Also since students do not face each other it is difficult to have any kind of debate on the topic. For any debate, it is essential for the speakers and audience to face each other. According to this research, this is one problem that is widely noted but still persists in Saudi all-female universities.

Information technology is widely used in almost every industry sector today. Modern education depends significantly on information technology and hence most western universities are investing heavily in developing their technology infrastructure. In

professional considerations, it is essential to provide employees with all the technological capabilities that would help them in providing quality education to students. However, as per the respondents of this research poorly designed technological infrastructure make it difficult to provide the level of technological service that teachers would require to provide quality education. For example, not the whole campus has wifi connectivity and teachers have to resort to handouts rather than providing online presentations. One of the key issues here is that technology is considered not essential for female universities, as most of the courses taught in these universities are non-technical in nature. There is a generally held opinion in the kingdom that women are supposed to study social science subjects and are supposed to take care of household work. This is the reason why technology is not considered as essential in female universities in Saudi Arabia. However, lack of focus on technology means that students are not taught independent learning through the use of sources available online. This is one of the reasons why most of the students in Saudi universities are used to read hard copies. There are several problems with this approach. Firstly, most of the materials available in the libraries are old and students are often deprived of latest and cutting-edge knowledge in their subject areas. Secondly, libraries can only store a limited amount of material which also restricts the breadth of knowledge that students can access and possess. Thirdly, students have limited exposure to e-learning even though e-learning is considered essential for the development of independent learning skills development in modern technology based environment. Finally, students do not gain the necessary technological skills they require for successfully competing in today's marketplace. Despite so many benefits of technology for students and teachers alike, there is limited focus on technological aspects of the workplace. For this reason, the designers recommended that there should be greater participation of participants such as technology consultants to make sure that the buildings designed are designed for future and not for the past. The problem, however, is that sponsors often keep control of the designs in their hands. The lack of understanding of the needs and expectations of the employees make it difficult for the sponsors to constructively contribute to design of the project.

The technology was not the only aspect highlighted in the research. There was also mentioning of how the ability to interact with other staff members affects their ability to be creative in teaching. Many teachers commented that discussing with others allows them to free up their mind and make them more energetic and creative. Yet, most of the all-female universities in Saudi Arabia do not have common areas for teachers to sit

down and interact with each other in a relaxed atmosphere. Since the teachers do not interact with each other as much there is not a real sense of social cohesion between them which makes it difficult for them to exchange knowledge with each other. According to the respondents, this has a significant impact on their productivity as per their own assessment.

There are also health and safety issues as highlighted by women, however, these were not emphasised enough by most of the respondents. Similarly, designers mentioned that all health and safety guidelines are followed. According to the respondents, university work does not involve any mechanical work and hence health and safety threats are generally low but whatever health and safety issues are there are addressed as per laws.

One of the problems with designing as per professional needs of the respondents is including their perspective. Teachers are almost never involved in designing a university and due to religious and cultural issues, it is not possible for designers to observe the teachers at work. As per the designers lacking direct knowledge of what teachers need and require professionally, they resort to ideas from other sources with no guarantee that this might or might not work. The problem occurs when other factors such as cultural and gender issues start to play a more significant role in the determination of the needs of the occupants as compared to their professional needs. Without the adequate participation of the occupants in some manner (either direct or indirect) it is difficult if not impossible to design workplaces which meet their professional needs. This is so because teaching is a highly skilled job in that teachers need to cater to the learning behaviour of each of the students

In other aspects discussed respondents mentioned several other features such as noise disturbance which also affect their ability to do their job. In addition, easier access to facilities was also cited as one of the factors that could determine how the workplace design contributes to the functional quality. For example, it was found that in one of the universities teachers were visiting library less frequently because of difficulty in accessing it. The library was housed in a building separately from the main university building. The walk to the library building was too long and was especially difficult given the heat due to sunlight as there was no covered path between the university building and library building. Having a bigger library is likely to provide benefits to the teachers and students only if access to the library is easy because this will have a direct impact on the

usage of the library. This means that having facilities is as useful but so is the accessibility to these facilities.

Respondents recommended that a chart should be prepared to outline the various activities that the teachers undertake in order to accomplish their tasks and then look at environmental requirements for each one of them: For example, tasks include accessing latest content, preparing lectures, giving lectures, engaging in debates, giving feedbacks. Each one of these tasks has some environmental requirements which workplace design must satisfy. For example, roundtable arrangements are necessary for debates and adequate lighting arrangements for delivering PowerPoint presentations through projectors. Lack of these is likely to affect teachers to engage students in debates or to provide powerful presentations. According to the respondents by not providing the right environment for organising debates, universities are basically refraining teachers from organising debates essentially curbing the possibility of debate which is likely to affect the learning of students. In this manner, the workplace designs can have a significant impact on the employee output. Teachers themselves require a specific environment in order to be able to focus on their work which is to access the latest content related to their subjects and deliver it to the students in a manner so that it helps the students in constructing knowledge. These are professional considerations that need to be taken into considerations while designing workplaces.

5.3 Considering occupant's culture in workplace design

Cultural factors affect people's behaviour and how they interact with their environment. Culture affects people's way of thinking and according to the respondents, cultural issues make it extremely challenging for the designers to design modernistic universities.

Most of the facilities in the universities are standardised based on the models adopted by other universities. However, in the case of Saudi Arabia, there is a conflict between culture and modernisation. For example, most modern universities built in western countries focus on natural lighting, as this is considered less stressful for the eyes making it easier to focus. However, in Saudi Arabia, religious and cultural issues mean that the windows have to be reflecting so that any outsider cannot see the females inside. This

also affects the lighting provision meaning that the teachers inside have to work under artificial lights.

Also because of the cultural issues, the inside of the building has a monotonous and simplistic design which can be quite boring for the individuals. One respondent gave an example of the offices of global tech giant Google and commented how Google uses innovative and mind stimulating internal designs to make the employees comfortable so that they can be relaxed and creative in their work. According to the same respondent, the inside of the Saudi all-female universities is in stark contrast with a high level of monotonous and simplicity which inhibits creativity. In fact, as per the designers, these monotonous and simple designs are governed by the Islamic principles which place strong restrictions on the use of figures and images as well as colours. The Saudi government is a patron the grand mosques and is obliged to do everything according to Shariah laws. Since Saudi government is a direct sponsor of these universities, it tries to ensure that everything within these universities is a reflection of Islamic Shariah principles. However, modern universities are all a good mixture of science and aesthetics. The problem is that the science of the place is little known due to lack of field research on the topic.

Respondents suggested that certain universities are considered better than others because of the overall academic environment they provide and it comprises not only of teachers and facilities but also the university design and architecture which itself can be stimulating or inhibiting for creative thinking. While male universities have been modernised to a great extent same cannot be said about female only universities where the focus remains on culture, traditions etc. in line with Islamic Shariah principles.

According to the respondents of this research, universities are not simple buildings with a number of educational facilities. Designing them requires a great deal of understanding of the people and the work that they do and this becomes quite difficult in professions such as teaching which are non-manual in nature. This is so because it is difficult to determine how different aspects of workplace design affects the psyche of different individuals and how it affects their performance. In this respect experimenting with new ideas and getting more stakeholders in the designing process can help unravel some solutions which have been ignored till now. However, respondents suggested that Saudi culture is opposed to experimentation as they prefer to avoid uncertainty especially with something related to culture.

In Saudi Arabia has a monotonous culture and this makes it both easier and challenging for workplace designers. It is easier because single culture minimises cultural conflicts which make it easier to incorporate and accommodate. On the other hand, cultures like Saudi culture which have strong reservations against modernisation makes it difficult to push for reforms involving modernisation.

In terms of individuals' preferences culture has a definitive impact on what people prefer. For example, many teachers expressed a desire to have some degree of separation from the students which indicates power distance aspect of Saudi culture. The power distance aspect of culture is evident in the workplace design arrangement preferred by the respondents which indicated preferences for separation but the ability to monitor other people and students i.e. people at the same or lower power levels.

In Saudi Arabian culture, windows need to be silvered so that anyone outside cannot see women occupants inside the building. The problem with reflective sheets is that they reflect light also meaning little light comes inside the building. This affects the availability of natural lights inside the buildings. Staying constantly under electrical lights has a stressing impact on the occupants of the building. As per the respondents, they are normally alert in the morning but their alertness wears off as they spend their day working under electrical lights. Saudi Arabian culture involves a preference for privacy. This is quite challenging for designers because they need to design universities, which allow occupants private space while also allowing them the flexibility to interact when they wish with the other occupants.

Technology, especially internet, is considered by many Saudi residents as against Shariah principles. This is one most significant barrier for the designers as they often restrict their designs; for example, they only have provision for the internet on designated computers and even then there are restrictions on the websites those can be accessed. On the other hand, evidence from studies conducted in western universities exhibits the significance of providing internet connectivity indiscriminately across the whole campus.

One of the main issues highlighted by the designers was the supremacy of religion and culture. According to the respondents, they tend not to experiment or design anything on their own without the approval of the Shariah committee because they fear that any attempts to do this will require redoing the work. The problem is that the Shariah committees tend to look at designs from the only religious point of view and do not

possess the knowledge of professional and other issues. In Saudi Arabian culture Shariah principles are supreme and even those aspects which may be practically useful but are against Shariah principles are ruled out.

Entertainment is prohibited in Islam and this is evident in designs of Saudi al female universities as well. There are hardly any places for the occupants to unwind and relax. Such places are considered against Shariah principles. Many respondents suggested that they have no place to socialise and hence they have a relatively weaker relationship with their colleagues as compared to what they could have if they could socialise with them. This desire to have a place to socialise is also driven by Saudi cultural attribute of collectivism which "represents a preference for a tightly-knit framework in society in which individuals can expect their relatives or members of a particular in-group to look after them in exchange for unquestioning loyalty" (Hofstede, 2016).

As per the respondents, the narrow view of the culture often affects the quality of design. In terms of design, most of the cultural focus is on architectural aspects but very little on interior designing aspects. Saudi culture is quite strong and it affects the way in which people interact and exchange information. In Saudi Arabia's collectivist society social interaction among individuals is a key aspect of their life. As per the comments of the respondents, the sponsors often adopt a narrow view of the Saudi culture thereby incorporating it only in architecture but not considering the internal environmental aspects which affect the behaviour of the people.

There seem to be quite contradictory themes emerging about the culture from the views of the respondents. The contradiction could be because of the different projects that the designs have worked on. Broadly speaking culture is considered an absolute essential for external architecture of the building. Internally space is designed so as to provide privacy to the teachers. However, Saudi Arabia society is a collectivist society which values teamwork. This means socialisation is quite critical and this can be best achieved by adopting open designs rather than the current closed designs. However, the high power distance aspect of Saudi culture warrants some degree of separation between the teachers and the students.

This indicates that there is a need for separate communal areas for teachers and students. However, in the three universities included as case studies in this research researcher did not find any such communal areas. Communal areas are the areas which the occupants

can use for recreational purposes. The only communal areas provided were the areas in the lounge/ galleries where some sofas were placed. However, these areas were mostly vacant as these were not properly ventilated and sometimes no air conditioners were installed in these areas. Based on researcher's observations it is fair to say that communal area did not exist in any of the three universities that the researcher visited. This indicates that the all-female universities in Saudi Arabia are still being run on the traditional education model but not on a constructivist model which indicates that we learn through or interactions with other people and our environment.

Piaget (1970) strongly believed that knowledge is a self-constructive process, therefore, his view can be considered as constructivist. This knowledge is not yet discovered and is out there, the learner actually invents and reinvents it over and over as through their interaction with the world. Learners accordingly engage with their environment actively and acquire knowledge through it.

The traditional education model adopted in Saudi Arabian all-female universities is based on the view that teachers are the sole and only source of education and that teachers themselves are experts who know everything about the subject. However, this is a model of education has been significantly challenged by the constructivist view of education which suggests that knowledge is not permanent and that all humans continue to construct new knowledge based on their interaction with other people and their environment. In this respect considering teachers as the sole providers of education is not a good idea. Teachers are also learners and hence teachers need to construct new knowledge in order to be able to teach effectively. For this reasons it is essential to provide teachers with an environment where they can learn and teach. In this respect, there is some degree of conflict in Saudi culture where teachers are considered supreme knowledge bearers who possess all the knowledge to teach and do not need to acquire additional knowledge. In reality, teachers are facilitators of knowledge who need to continue to acquire new knowledge and stimulate learning among the students through constructive engagement. In this respect, workplace environment needs to provide an adequate environment for teachers to learn as well. Modern education is based not on instruction but rather on principles of constructivism. Individuals learn through their interaction with their society, surroundings, as well as through their experiences. This is where the current designs are lacking because these focus mainly on instructional model of teaching which used to exist in past times where students were passive learners.

Cultural understandings can have a direct impact on the quality of output that the teachers produce. Teachers who are able to interact and socialise with other teachers at the workplace are likely to have a broader set of information and knowledge to share with the students.

5.4 Considering occupant's gender in workplace design

Both academicians and professional designers have largely ignored gender issues because most of the workplaces have workers from both genders. There is thus no specific consideration given to gender issues. However, in Saudi Arabia there is a high degree of gender segregation and hence there are workplaces which are occupied entirely by either males or females. Due to this reason, it is possible to incorporate gender aspects into design considerations in order to boost employee productivity.

It is a challenge because it creates challenges in collecting observational data about workplaces. Male designers are not allowed to observe female employees at work making it difficult for people to collect data about workplaces usage by people of another gender. Saudi females are used to live in segregation in Saudi society and this leads to the development of female-specific habits and behaviour. These are not evident in a western world where no such gender segregation exists. Thus, workplaces designed of western designs may not be suitable for Saudi Arabia because of the difference in the level of gender considerations.

When asked designers suggested that Saudi women have a different kind of upbringing whereby they spend less time in professional spaces and more in socialising spaces. This starts to affect their preferences, as they feel comfortable in familiar surroundings, which they can adjust as per their requirements. Furthermore, Saudi females tend to have a degree of privacy regarding their own space. Their preference for privacy and customisation of their surroundings need to be reflected in workspace designing. However, the current approach to university designs does not provide females with either of these.

Saudi females like to socialise and much of their learning right from their childhood is driven by their interaction with other females. While they need to develop subject specific knowledge through more formal sources of information but at the same time, the

process of knowledge construction within Saudi females cannot and should not be ignored. According to the respondents, Saudi females have a greater need for socialisation as compared to Saudi males.

Saudi females are generally in control of their environment at home and this also affects the gratifications they derive from their surroundings. Customisability and privacy at workplace can help them achieve similar gratifications from work environment.

Females also have different physical requirements as compared to men. For example, Saudi females are generally brought up in an environment, which lacks scope per much physical activity. As a result, their ability to engage in physical activity is quite limited. This means that the workplaces need to be designed and organised so that it minimises physical activity. In one of the university, respondents claimed about improperly located toilet facilities which made it difficult for females who need to visit toilets quite often. According to the respondents having poor access to toilet facilities make it difficult for them to access the toilets often as required and this very often affects their ability to focus on their work. Accessibility was also mentioned to be a key barrier in one of the universities where the respondents claimed that the university library was located too far and for that one reason they do not use it as much as they would like. Some of the respondents commented that they have back problems and the drawer arrangements which requires them to bend down quite often is physically challenging for them. Furthermore, in one of the universities, at least seven different individuals complained about the height of the table. Women are generally shorter in height and hence furniture designed for their offices should be specific to their physical appearance. The best approach will be to have some sort of adjustable furniture which the occupants can adjust as per their needs. Adjustability and control are also discussed in the cultural considerations section.

In terms of gender certain respondents also pointed towards aspects of their life such as what they wear and how it affects their movement and ability to perform. For example, hard sole footwear is quite common among women so hard floors are not suitable not only because they are health and safety hazards but also because the heels make a lot of disturbing noise while walking. Adequate ventilation is essential to make sure that they get adequate air and do not feel too warm.

Saudi Arabian society, in general, is male dominated and hence most of the workplaces are designed as per the needs of the men. The problem occurs when same models are replicated for female only workplaces like female only universities. Most respondents agreed that special considerations need to be made in order to understand how women are affected by different aspects of the workplace. Respondents recommended two things to do that: firstly, increase participation of women in designing profession so that they can provide meaningful insight into what modifications are required for female only workplaces. Secondly, to increase the experimental and observational data on usage of the workplace by female teachers. This data can help the designers make design decisions which are suited for female workers.

Chapter 6 Conclusion

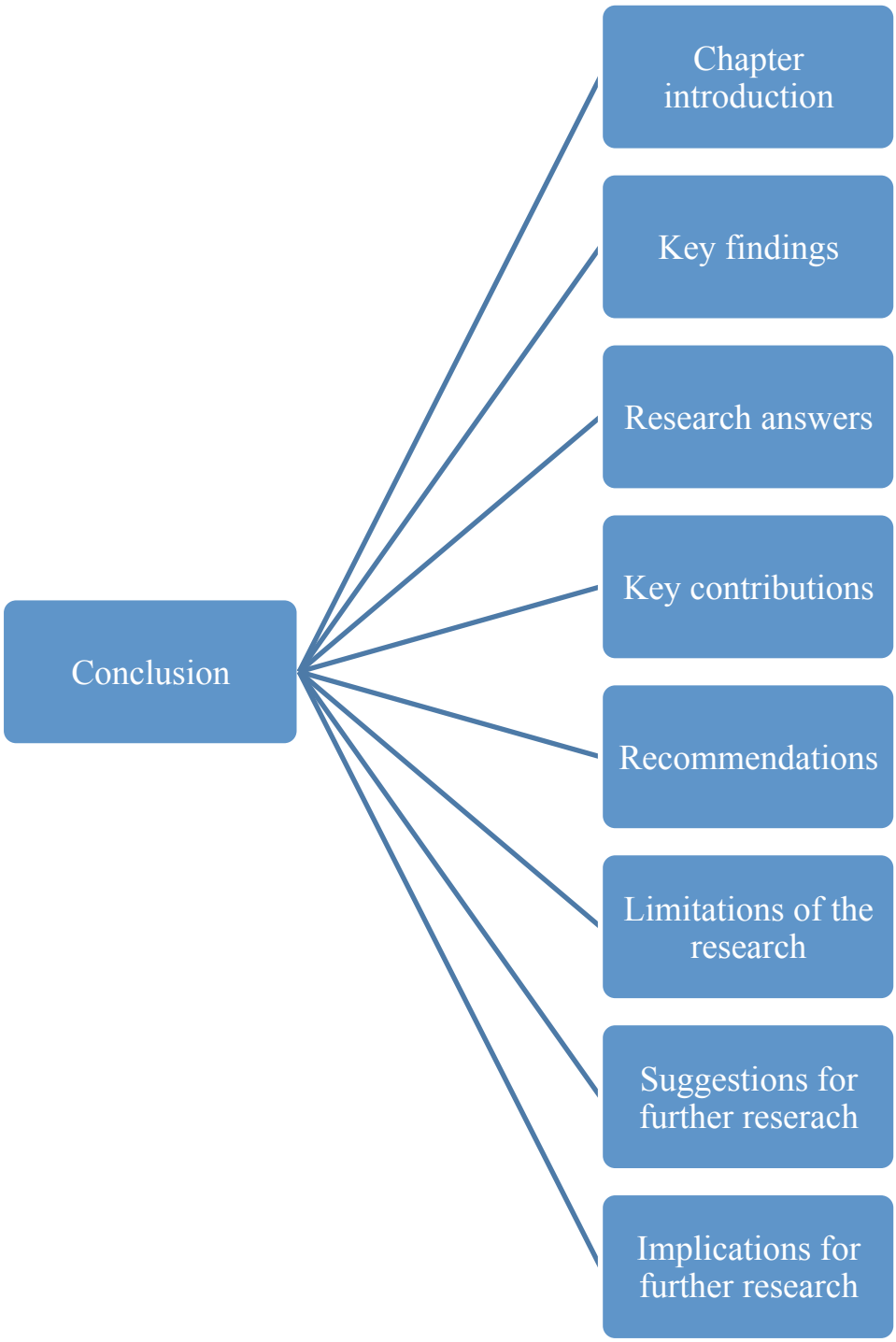


Figure 32: Structure of the conclusion chapter

6.1 Chapter introduction

This research advances the concept of workplace designing, especially for university buildings. This research used a highly contextual case of all-female universities in Saudi Arabia as an example for this research. Saudi Arabia is a gender segregated society in which females have generally been deprived of several opportunities because of the gender segregation in workplaces. Saudi female universities are unique because of the highest level of gender segregation practised there.

In several societies in the developing world, the gender bias in workplace designing leads to deprivation of females. However, by designing workplaces for females it is possible to motivate more females to become part of the workforce and thereby reduce the gender bias.

This research particularly looked at how designers consider different aspects that will affect occupants' experience of the workplace and consequently their productivity. To achieve this objective this research began with the identification of key workplace design considerations that may affect employee productivity. In this respect, the author deliberately diverted her attention away from non-ergonomic aspects because these have been extensively researched. Researcher instead focused her attention towards cognitive aspects. The case study of all-female universities in Saudi Arabia were selected because these provide a rich context to study the cognitive aspects of workplace design and also because of the researcher, being a female from Saudi Arabia, wanted to make a meaningful contribution towards increasing women participation in intellectual fields. Thus, the researcher looked at gender, culture and profession aspects of workplace design. The researcher believes that these three design considerations affect the cognitive quality aspects, which in turn affect the performance of workers employed in intellectual professions.

In this context, this research looked at whether it is useful to consider gender, profession and culture of occupants when designing workplace. This usefulness is determined by the contribution of such considerations to the productivity of female academics working in Saudi all-female universities.

The primary research included two set of respondents. Firstly, female academics provided self-observation data in form of comments using a mobile app which was

developed specifically for the purpose of this research. This data was quantified using thematic analysis approach and quantified data was analysed using regression analysis. The second aspect of this research included collecting quantitative data using semi-structured interviews with designers who have worked on designing all-female universities in Saudi Arabia. Designers were interviewed about how do they take profession, culture and gender of occupants into consideration when designing female universities in Saudi Arabia and how these considerations can be improved further so as to make the workplace environment more effective in terms of boosting the productivity of female academics. A model containing various aspects of culture, gender and profession that needs to be considered while designing female universities in Saudi Arabia was the main contribution of this research.

This chapter summarises the key aspects of this research. In particular, it looks at the findings and contributions of this research, its limitations as well as suggestions at how this research can be further expanded.

6.2 Summary of research

This research aimed at identifying the impact of accommodating professional, cultural and gender considerations when designing workplaces on employee productivity

This research primarily aimed to understand the following:

- How can professional, cultural and gender consideration be included in workplace designing: Past research have talked about different ways in which workplace designs can be considered. This research looked at how the workplace is designed from the perspective of the key decisions/considerations at the time of workplace designs. This research finds that most of the past research looked at environmental, physiological and other aspects but there has been a relative lack of research on how design considerations affect the quality of design.
- What are the different aspects of design quality: There is also a lack of clarity on how the quality of workplace design can be defined. This research looks at quality design from three perspectives: functional, psychological and social. According to the findings of the literature, these are the three dimensions on basis

of which it is possible to evaluate if the workplace design is adequate or not. For example, if the workplace design has the high functional quality it means it is useful in assisting employees in accomplishing their tasks. Similarly, psychological quality of workplace design affects the psychological state of employees.

- How to determine employee productivity of Saudi female professors teaching in Saudi all-female universities: There are different measures of measuring employee productivity in different kinds of jobs. Past research has also used a number of different ways to measure teachers' productivity such as the number of journal publications, research activity, student grades, the number of hours at work etc. However, all these measures seem to be selected on grounds of ease of measure. According to the researchers, this can be because of the "lost key syndrome" in which individuals search for key not where it is to be found but where it is easier to look. In this research, the critical aspect is to evaluate how workplace design affects productivity. The interaction between workplace design and employee productivity is continuous and not aggregated as is evaluated in past research. In the case of teachers, the impact is psychological and teachers can only reflect on this interaction in real time. Trying to collect past information may reveal perceptual information rather than factual information about their productivity was affected by workplace design aspects. This means it is essential to collect information about this interaction between workplace design and employee productivity in real-time. It will be futile to expect teachers to remember how workplace design affected their day to day activities in past. This research thus aimed to look at the impact of workplace design on employee productivity in real-time.

In terms of productivity, this research looked at two aspects of productivity, employee and organisational outcomes. Absenteeism and lower output are organisational outcomes, which affect the output that the employee can draw for the organisation. However, in today's business environment employee outcomes are also considered quite critical for the organisation because of employee outcomes such as stress, motivation, anxiety, satisfaction etc. affect employee's productivity in long run. Hence this research looked at both employee and organisational outcomes as measures of employee productivity.

- Identify how different design considerations affect workplace quality and employee productivity: This research finds that all three kinds of design considerations i.e. cultural, gender and professional design considerations affect employee productivity. Professional design considerations affect the functional quality of the workplace and consequently organisational outcomes. However, cultural and gender considerations affect the social and psychological quality of the workplace and consequently employee outcomes. This research also confirms that employee outcomes affect organisational outcomes. In this respect gender and cultural consideration in workplace design also affect organisational outcomes by influencing employee outcomes.

This thesis comprised of six chapters. The first chapter provides an overview of the research problem. It provides the reasoning why it is essential to investigate this phenomenon and the contribution of the research was discussed. It was clarified that most of the past research has provided a limited insight into what kind of factors are to be considered while making workplace design decisions. This thesis looks at how different forms of design considerations affect the effectiveness of workplace design in terms of its impact on employee productivity. Chapter 1 also contained the aim and objectives of this research along with the research questions that this research aims to answer.

Chapter 2 presented a thorough literature review on the subject of workplace design and employee productivity. This research is based on the view that there is a proven link between workplace design and employee productivity but having learnt this there is now a need to explore this relationship in depth i.e. to understand how to put this knowledge into practical use. In order to do so, it is essential to understand the nature and aspects of the relationship between workplace design and employee productivity. Literature review resulted in the identification of key aspects of design considerations and workplace design quality aspects. The literature review also resulted in identifying that employee productivity comprises of employee outcomes and organisational outcomes.

Chapter 3 presents an overview of the research methodology and data collection procedures adopted. This research was completed in three stages. The first stage began with an extensive literature review which helped the researcher in identifying research gaps and in developing the conceptual framework. The second stage of the research

involved a collecting self-observation data through a mobile app. A mobile app as designed for the users to send relevant information to the researcher in real time. This chapter presented details of how the app was designed, how data was collected using the app and how data was quantified. The challenges faced during the process of collecting data using the app were also discussed in this chapter. In the third stage of the research, the researcher conducted interviews with designers who have worked on projects involving designing of Saudi all-female universities. Interviews were aimed at obtaining greater insight into the findings of the self-observation and to identify possible solutions to how workplace designs can be improved to boost employee productivity in Saudi all-female universities. This chapter discusses the benefits of using pragmatist philosophy and mixed methods for this research. Data collection procedures, sampling and limitations of data collection methods are discussed in detail. In addition, validity and reliability of the data collection methods adopted in this research are discussed.

Chapter four of the research presented findings of the data analysis. This chapter is divided into two parts. The first part presented the statistical analysis of the quantified self-observation data Regression results are presented and a brief discussion is provided. Section two of this chapter presented an analysis of the interview data. Data for the interviews is analysssed according to the themes identified according to the conceptual framework. This research finds that all three kinds of design considerations i.e. cultural, gender and professional design considerations affect employee productivity. Professional design considerations affect fthe unctional quality of the workplace and consequently organisational outcomes. However, cultural and gender considerations affect the social and psychological quality of the workplace and consequently employee outcomes. The findings of the interviews revealed how workplace design can be improved through consideration of cultural, gender and professional considerations in order to boost overall employee productivity in Saudi all-female universities. This research also finds that professional factors are currently the main focus of designers but the benefits of professional design considerations are somewhat offset by poor consideration of gender and cultural aspects. This research, therefore, recommends that instead of replicating existing designs, designers should consider the factors specific to the university and its occupants.

6.3 Key findings

There are two sets of findings. One set of findings which are generally applicable to universities worldwide and the other which was specific to Saudi all-female universities.

General findings: Most significant aspect of workplace designing is its functional quality i.e. the manner in which a workplace design assists the occupants in accomplishing their professional tasks and goals.

Personal space was found to be one of the key dimensions of workplace quality. People's desire for personal space is affected not only by their gender but also profession and culture. This research finds that allowing personal space management is one key aspect that could help improve workplace quality and consequently employee productivity. In this respect providing amendable design solutions such as modular and movable furniture, ability to control lights and air and, if possible, colour in the room. In this respect using coloured LED instead of monotonous lights can be a useful stress reliever for teachers.

Responsiveness of workplace to the personal and professional needs of the occupants is critical for improving workplace design; for example, having designs which will facilitate interaction between individuals such as round table arrangements in discussion rooms and in classrooms. Workplace designs also need to respond to the changing nature of the profession. In the framework, gender and culture of the occupants are stationary aspects but professional aspects are constantly changing. The workplace designs need to change with the changing nature of teaching profession. For example, many respondents mentioned that the workplace facilities provided are not conducive to modern and interactive learning technologies such as e-learning. Part of this could be blamed to the retrospective view taken by designers when designing universities. The need is to take the futuristic view and this is only possible through the active participation of the intended beneficiaries (i.e. the teachers) in the designing process. For example, inadequate wifi access across the campus leads to lack of use of online learning methods such as e-learning. This has a significant impact on teachers' ability to teach because they cannot engage in prompt discussion but rather remain restricted to a prepared teaching plan. This inhibits their creativity to provide more in-depth and interactive lessons.

Designs that support work groups are found to be useful in university designs. This is mainly because education is constructive in nature i.e. it is a construction of knowledge through the interactions with other people. Thus, the workplace designs need to help people interact by providing more social spaces. This will help them form ad hoc groups, which will help them construct their knowledge better.

Saudi all-female university specific findings: The most common words mentioned in the self-observations data were "boredom" "stress" "anxious" and "tired". This research finds that providing teachers and students access to sources to kill boredom and anxiety is especially critical for Saudi female universities because due to cultural segregation they cannot seek any mean of killing anxiety or boredom outside the university building. For example, a space for socialisation was found to be lacking meaning teachers had limited opportunities to interact with each other. Whatever seating areas are provided are in middle of walkways and provide seating for no more than two or three individuals which are quite small considering that every university may have hundreds of teachers. Being in the middle of walkways means the teachers cannot be in a relaxed environment with teachers and students passing through that area.

The location, as well as design of the workplace, can promote or present opportunity for communication. Communication and interaction are two key aspects of Saudi culture and female gender. This was mentioned many times in the self-observation data and the designers also suggested these to be critical aspects. There are however many factors that determine the nature of the interactions in a workplace, these include, sense of control, nature of the work, proximity to colleagues and the access and proximity tof meetings and other interaction friendly places. This research finds that workplace design in Saudi female universities should allow interaction and communication rather than isolate the employees. Although this does not mean open plan workspaces will be useful but that individuals should have spaces specifically for this purpose.

Some teachers also stressed the need to provide some form of green and semi open area within the university building. Due to gender segregation Saudi female universities are designed in a closed manner which give the impression of a restricted space to most of its occupants, By providing semi closed areas (areas which are open at the top but closed from other sides) will give the teachers a feeling of normality and freedom which will reduce the levels of anxiety and depression.

This research also finds that female teachers find it physically exhausting to work longer hours and hence providing them with a place to physically relax can be quite helpful for most teachers. For this reclining chairs or therapeutic chairs will be helpful. Current seating arrangements, as well as desks, were found to be too rigid and hard for any physical comfort.

6.4 Research answers

The first and foremost this research wanted to identify what are different aspects of design considerations that the designers need to consider at the time of designing workplaces. In order to do so designers need to consider both personal and professional aspects because both professional and personal aspects affect employees' satisfaction and performance. However, workplaces are designed in a collective fashion and it is not always possible to do individualised level designing. Hence, only those personal factors which can be considered at collective/ group level are considered in this research. Professional aspects were therefore considered under professional consideration while cultural and gender aspects represented personal aspects. Past research has also mentioned as these factors being critical design considerations in workplaces. Over last few decades, there has been a consistent rise in women participation in the labour market and consequently, there has been the development of more unisex culture at workplaces where there is no specific consideration is given to the gender aspects. However, researchers have strongly argued that such practices are discriminatory towards women because most of the unisex designs are skewed in favour of men. The drawback of this is heightened levels of anxiety and stress among female employees and consequently impact on their performance.

This research also aimed to find out whether workplace design affects employee productivity. Past research has strongly supported the view that workplace design affects employee productivity and this research also supports these findings. Workplace designs affect both the psychological and physiological well-being of the occupants and consequently affect their performance.

6.5 Key contributions

The first and foremost contribution of this research is that it goes beyond existing set of research on workplace designing. Most of past research on this subject has focused on professional aspects alone while ignoring the human aspect of organisational performance. In most professions today the performance of the organisation itself is directly and strongly linked with employee outcomes such as satisfaction and motivation etc. Since these aspects also affect the performance of the employees especially when the nature of work is non manual, it is essential to consider these aspects when designing workplaces.

One of the key achievements of this research is the introduction of the mobile app as a data collection tool. While mobile apps have been used for various professional purposes, but as far as researcher's knowledge is concerned there has been no academic research till date which has used mobile apps for data collection. However, this research demonstrates that there are circumstances in which using mobile apps for collecting self reported data is quite useful. The rise in ownership of smartphone means as most of the adults around the world have access to mobile phone's round the clock. This makes it easier to collect self reported observation data using mobile apps. This is non invasive and provides a direct, real time mode of communication between the researcher and the respondent.

Another key contribution of this research is consideration of both employee and organisation outcomes as factors defining employee productivity. This research provides a more holistic definition of employee productivity in which is in line with the new strategic human resource management perspectives, which identifies employee satisfaction and motivation as key ingredients for organisational success.

This research also identifies that employee productivity as both implicit and explicit elements. For implicit aspects of employee performance self reporting is proposed as the most effective method of measuring employee performance.

6.6 Recommendations

Understanding the kind of issues that women workers face such as anxiety and depression, fatigue, boredom etc. is critical in designing workplaces which can boost the productivity of female workers. Even for the same issues, the solutions for male and females may be different. For example, males and females may differ in their choice of stress relievers. Males and females also have different body structure and hence the internal furnishings should be designed so that females can use it with ease.

Workplace designers need to consider both individuals and social aspects of workplace design. One of the problems identified in this research is that most of the designers look towards western universities for design inspirations. However, as per the findings of this research, it is essential to consider local context especially local culture when designing workplaces. Culture is one of the key barriers for designers while designing workplaces for Saudi females as Saudi culture requires complete gender segregation in addition to several other restrictions. Understanding the local culture and balancing it with the professional and gender aspects of workplace design is required in order to design workplaces which meet all round needs of the occupants.

Professionally it is essential that workplaces are designed bearing future developments in mind. For example, lack of wifi connectivity in the university was cited as one of the major issues faced by teachers as they need to prepare everything in advance and could not provide real time information to their students. Furthermore, very few students and teachers access Internet through library facilities and consequently, there is not much focus on e-learning. This evidence indicates that designing universities so that these align well with future developments in the field of education will help in improving the overall quality of education.

According to the respondents, the designs in Saudi universities are quite rigid providing very little options for alterations. Providing flexible workplace designs allow the workplace occupants to alter their workplace environment as per their needs. However, in all of the three universities, the workplace designs were more or less fixed which means that the individuals had no option of making changes as per their needs. The current standardised model means that the designers consider all individuals to be

identical with identical needs and requirements. This is far from reality. Modern age workers are more demanding and like to be in control of their environment in order to be able to put in their best efforts. This is especially true for intellectual professions which involve minimal physical effort.

One of the interesting suggestions given by some of the respondents is that universities can be designed as a place where females can access facilities which they cannot generally access outside such as physical exercise. In Saudi Arabia, most of the females are generally confined to their homes or workplace buildings and as a consequence, they get little opportunity to engage in any form of physical exercise. In this respect, the university designers can play a vital role in lives of these females by providing them facilities, which they can use to engage in some form of physical activity. This is likely to improve their mental wellbeing as well and this will, in turn, allow them to be more creative and effective in their profession.

This research finds that organisational outcomes are linked with employee outcomes. This means that designers need not only provide facilities that are required for professional needs but also try and meet the personal needs of individuals in terms of killing boredom, relax mentally and physically, engage in social interactions etc. This will help the management to reach their organisational goals by assisting the employees in meeting both their personal and professional needs.

6.7 Limitation of the research

This research has some limitations which need to be considered while reading the findings of this research:

Firstly, the data was collected using self-reported observation method. Although the researcher provided sufficient explanation to the respondents in the two briefing sessions but there is a possibility that some respondents may have still not understood the process of data collection and the purpose of the research. Since the researcher had no direct involvement in the data collection form the app and hence there is a possibility that some

of the respondents may have provided incorrect responses. The researcher tried to resolve this problem by filtering out the irrelevant responses but there is a possibility that some incorrect information may have still remained.

Secondly, researcher provided complete anonymity to the respondents. Data was collected from three universities but due to the complete anonymity of the respondents, it was not possible to determine how many respondents from each university participated in the research. There is thus, a possibility that there were too many respondents from one university and too few from another leading to some degree of bias in the data. However, providing anonymity was considered an absolute essential not only to ensure that all ethical considerations are met but also to ensure that respondents provide a true and large quantity of information without fear of repercussions.

Thirdly, there was a possibility of errors in quantification data. Qualitative data was thematically analysed and then quantified as per the pre-identified themes and author also remained open to identify new themes. However, the author had her own set of knowledge, which could have led to some interpretation bias. In order to ensure that there was no interpretation bias author cross-checked her quantification coding with that of two independent researchers who are qualified to the PhD level and were briefed thoroughly about the research, conceptual framework, coding technique etc.

Fourthly, data for this research was collected using semi-structured interviews with the designers. It is a possibility that these designers may have provided biased responses due to fear of embarrassment or repercussions. But since the researcher wanted to collect detailed responses on an issue which has not yet been researched, interviews were the only possible for of data collection. To alleviate any fears that the respondents may have had, researcher provided them with a written guarantee of complete anonymity.

6.8 Suggestions for Further Research

There is a possibility of including more human aspects to enhance the conceptual framework.

This research is based on self observation data. This research can be extended to include other research methods or even adopt an experimental study to see whether considering these factors (culture, gender and profession) may lead to improvement in productivity of employees.

Similar research can be conducted in other industry sectors or even cross industry level to see if the findings of this research can be generalised.

This research can also be extended to include students as the respondents to see if their experience is affected by university design.

6.9 Practical implications of the research

This research was aimed at providing an insight into those aspects of workplace designing which have a key impact on employee productivity and yet are often ignored. This research was not aimed at looking at specific dimensions of the workplace such as what is the best type of layout, what should be the arrangement of lighting and windows etc. Rather this research aims to look at the link between characteristics of the employees (i.e. their profession, culture and gender) and their perception of the quality of the workplace and consequently their productivity.

The findings of this research have several implications, especially for the designers. Some specific recommendations emerging for this thesis are as follows:

- Controllability and privacy are especially critical for Saudi female academics due to their cultural and gender orientation. Giving employees customisable features at the workplace can be useful in allowing them to control and manage their workspace. This reduces the psychological stress that they face allowing them to focus better on work.

- It is essential to design university buildings so as to promote interaction between individuals including all the teachers and students. Universities should be designed not only to support interaction but rather facilitate interaction between individuals.
- Accessibility of facilities such as washrooms, library, wifi etc. is quite critical as this accessibility affects their perception of quality of the workplace and eventually their productivity.

There are also some general recommendations emerging for the workplace designers in general and these are as follows:

- One size fits all approach is not suitable when designing workplaces. Thus designers should consider each and every workplace designing project as unique and look at specific attributes of the occupants while designing workplaces.
- Workplaces should be designed to empower the employees and for this reason the designers need to collect detailed information on how the employees work. This data can be mostly collected using observation because it's not always possible for people to express what they might feel in a hypothetical scenario.
- Considering the professional aspects of workplace requires a close understanding of the explicit and implicit aspects of work. For example, teacher's work of teaching is not easily observable externally. It is thus critical to improving participation of the intended users of the workplace in the designing process.
- Gender considerations are quite critical because most of the past research indicate that the focus on workplace designs is generally biased towards males and this is one of the contributors why, in many societies, the participation of females in the workforce is considerably lower than that of males.

This research was not aimed at finding very specific and generic solution; on the contrary, this research is based on the view that a generic solution in workplace design does not exist. The aim of his research was to provide an insight into what kind of information the designers need in order to be able to design workplaces which boost employee productivity. In this respect, this research found that designers should formulate their design decisions within the context of the knowledge of culture, gender and profession of the intended occupants. Designers can collect employee personality-related information through focus groups, observations or even questionnaires aimed at learning more about the intended occupants, their personalities and the occupation itself.

Simply borrowing designs from one successful institution does not mean that designers can design the same level of the quality workplace because the people using these workplaces may simply have different preferences and ways of using their workplace due to their different culture, gender, and even way of doing things. Thus, contextualising workplace designs a critical factor in designing workplaces which boost employee productivity.

Thus, one of the key recommendations for the designers is to include information collected through focus group interviews and observation of the employees who are intended user of the workplace. Learning how the employees do what they do and discussing with them in order to uncover their tacit knowledge about their work as well as about their personality and how it may affect their interaction with their workplace environment, can be quite useful in workplaces which boost employee productivity. This is especially critical for intellectual jobs such as teaching where employee productivity is hard to define, measure and manage.

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Appendix 1: Interview questions for the designers

I sent you a copy of me conceptual framework. Do you have any comments on that. I mean do you think I have forgotten to include something or something I have included but should not have?

What are your initial thoughts when you plan to design a university for women? I mean what are the different things that you think of?

Do you get any specific suggestions from the ordering authorities regarding the designs for universities for females?

Do you give specific consideration to the profession of employees who will be using that workplace? Give me some examples please. For example, how would your design aspects change say between a hospital and a university?

How about consideration for the gender of the employees? Say if all the employees or most of these are females then what changes do you think would be required to the design of the workplace?

Do you think Universities in Saudi are designed differently than universities in other counties say in US? How do you think they are different?

Do you think cultural issues should be considered when designing universities especially female universities? How?

Now let us combine these three. What would be the main things you would consider when you design an all-female university in Saudi Arabia? Tell me all that you can think of and please give me some examples.