POLITECNICO DI MILANO

School of Architecture Urban Planning Construction Engineering

Master of Science - Management of Built Environment

NEW WAYS OF WORKING AND EMPLOYEE HEALTH

A selection of performance indicators to support facility managers and designers in selecting or designing a healthy workplace for knowledge-workers.

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Academic Year 2018 - 2019

Abstract

The approach to work is constantly evolving. This evolution affects the physical workplace, which had to undergo changes to accommodate New Ways of Working (NWW). Globally, 50% of the employees work from their main office about 2.5 days per week. The rest of the time they work from home, on the move, or from “third places”. This working arrangement has led to consequences on informal learning processes, employee productivity, workers’ health, etc. Among these consequences, the impacts of NWW on the health and well-being of workers is largely unknown.

This research aims at assisting organizations deal with the impacts of NWW on employees’ health and well-being. Addressing workers’ health and well-being is reliant upon having a preventive approach or an enhancement approach. This preventive mechanism is successful only when the causative factors can be measured for an evaluation to be made, and the necessary changes adapted. However, in current practice, NWW reiterates on the benefits workers derive from the autonomy of place and time. These benefits frequently overshadow the impacts NWW have on the worker especially in terms of health and well-being. In trying to fix this gap, first, a literature review was carried out to identify existing assessment tools for measuring health and well-being of workers. The need for establishing a synthetic set of key performance indicators (KPIs) emerged. Thus, this research developed a system of KPIs that can be used for measurement of health and wellbeing in the workplace.

In achieving the aim and objective of this research, a systematic review of KPI literature was conducted. This resulted in nine (9) specific publications which satisfied all the relevant inclusive and excluding criteria. From these publications, 147 performance indicators were identified. They underwent a series of analytical procedures that yielded 19 distinct KPIs. They were further validated, ranked using the Analytic Hierarchy Process (AHP) and subsequently evaluated within an organization that adopts NWW. The final set of key performance indicators caters for the physical work environment and psychosocial work factors. ‘Thermal Control Measures’ were adjudged as the most important KPI whiles ‘Biophilic Design Comfort’ came out as the least prioritised in this study.

In conclusion, a systematic approach involving empirical measurement procedures was proposed for the benefit of organizations that might want a comprehensive overview on their workers’ health and well-being. The results of this study will be highly valuable to facility management and workplace design practitioners to better implement practices that that will provide a healthy workplace for all stakeholders. This would also serve as a guide to all prospective designers during the modelling of the future workplace.

Table of Contents

List of Figures

List of Tables

Chapter 1 – INTRODUCTION

This chapter is an introduction to this research and can be considered to be the guideline of this research. First, the motivation for this paper is expressed in (section 1.1), stating the need and importance of this research. The problem analysis comes next, stating the problem this research seeks to solve, its aim, objectives and questions this research seeks to answer (section 1.2). The research framework follows next describing the steps taken during the research (section 1.3), then, the results we expect to achieve from conducting this research is expressed in (section 1.4). Finally, (section 1.5) gives the structure for the following chapters of this research.

1.1 MOTIVATION

In the summer of 2017, the authors of this research work participated in a workshop dedicated to workplace management. A lot of interesting ideas were exchanged from diverse industry personnel who elaborated on various dimensions of the workplace. One very interesting lecture was given on hospital design focusing on the users and workers' needs. In the end, an overall impression was made that the manner in which a hospital is designed and utilized generates a lot of social interactions among users which were observed as having underlying benefits to the health and well-being of workers. This discovery increased the author's curiosity to investigate the existence of these benefits in commercial spaces, such as offices.

Additionally, it was emphasized that in designing and planning of hospitals for patients, several considerations are made to make space serve as an enabling environment to hasten recovery. These considerations benefit other users whose workplace is the hospital. So, to satisfy this curiosity, this research was launched (1) to identify the particular health benefits being derived by workers from other forms of workplaces, (2) to identify the specific factors that generate these benefits, (3) to explore how organizations can adopt these health benefits, evaluate them and improve upon them.

1.2 PROBLEM ANALYSIS

Office buildings have been recently affected by New Ways of Working (NWW). The traditional manner of going to the office from 9 to 5 in a steady routine is changing toward a more flexible use of the workplace. The IWG Global Workspace Survey - Flexible Working (2019) report suggests that 50% of employees globally are working outside of their office headquarters at least 2.5 days a week. The advancement of flexible working means a shift in the method of management to one that gives employees greater responsibility. It does not just deal with autonomy but focuses even more on targets and results, and less on the number of hours worked (Blok *et al.*, 2012b).

Research by several authors suggests that the NWW bring positive impacts to both the employer in terms of productivity and employees in terms of work-life balance (Demerouti *et al.*, 2014; Shagvaliyeva and Yazdanifard, 2014a; Raziq and Maulabakhsh, 2015). However, few researchers have investigated and tried to address the impacts of NWW on the health and well-being of the worker. According to Clark's (2000) definition of work-life balance, "satisfaction and good functioning at work and at home, with a minimum of role conflict," employees are concerned about the possibility that bringing work home could make it difficult to separate work from their personal lives, leading to fatigue and other associated health effects.

The future of work lies in flexible working that fosters employee health and well-being and to achieve this, the work itself should adapt to the life of the employee and not the other way around.

Shagvaliyeva and Yazdanifard (2014) reports that the adoption of flexible working patterns in the workplace by organizations should be agreed upon only after investigating both the positive and negative effects.

One of the tough challenges for all researchers in this field in recent times lies exactly on how to identify, measure and assess the impacts of NWW and the associated health challenges it poses on employees in the workplace. This is the context where this thesis situates.

1.2.1 Aim

The aim of this research is to assist organizations to deal with the impacts of NWW on employees' health and well-being.

1.2.2 Objective

The objective of this research is to develop and validate a system of key performance indicators that can be used for measurement of health and well-being in the workplace.

1.2.3 Research Question

To address this objective, the following research questions have been formulated for the different stages of this research study and are presented below:

Research question 1	How does NWW affect the health and well-being of workers?
Research question 2	What are the current practises for measuring health and well-being in the workplace?
Research question 3	Are there in existence a set of actionable KPIs relevant to assessing the health and well-being of knowledge workers?
Research question 4	How can a selection of KPIs help to measure the impacts of NWW on the health and well-being of workers?

1.3 RESEARCH METHODS

The methodology employed for this study includes subsequent stages:

1. Theoretical definitions and dimensions of keywords employed.
2. A literature review of already existing assessment tools for the measurement of health and well-being in the workplace.
3. A systematic review of the selection of performance indicators from literature sources.
4. An analytical hierarchical analysis for ranking and evaluation of key performance indicators.

1.4 EXPECTED IMPACTS

The long-term goal of this research is geared towards the advancement of the state of the art and contribution to the field of workplace management through highlighting the health impacts of the new ways of working on employees' health and well-being. The results of this study will be highly valuable to facility management and workplace design practitioners to better implement practices that will provide a healthy workplace for all stakeholders. This would also serve as a guide to all prospective designers during the modelling of the future workplace.

1.5 RESEARCH STRUCTURE

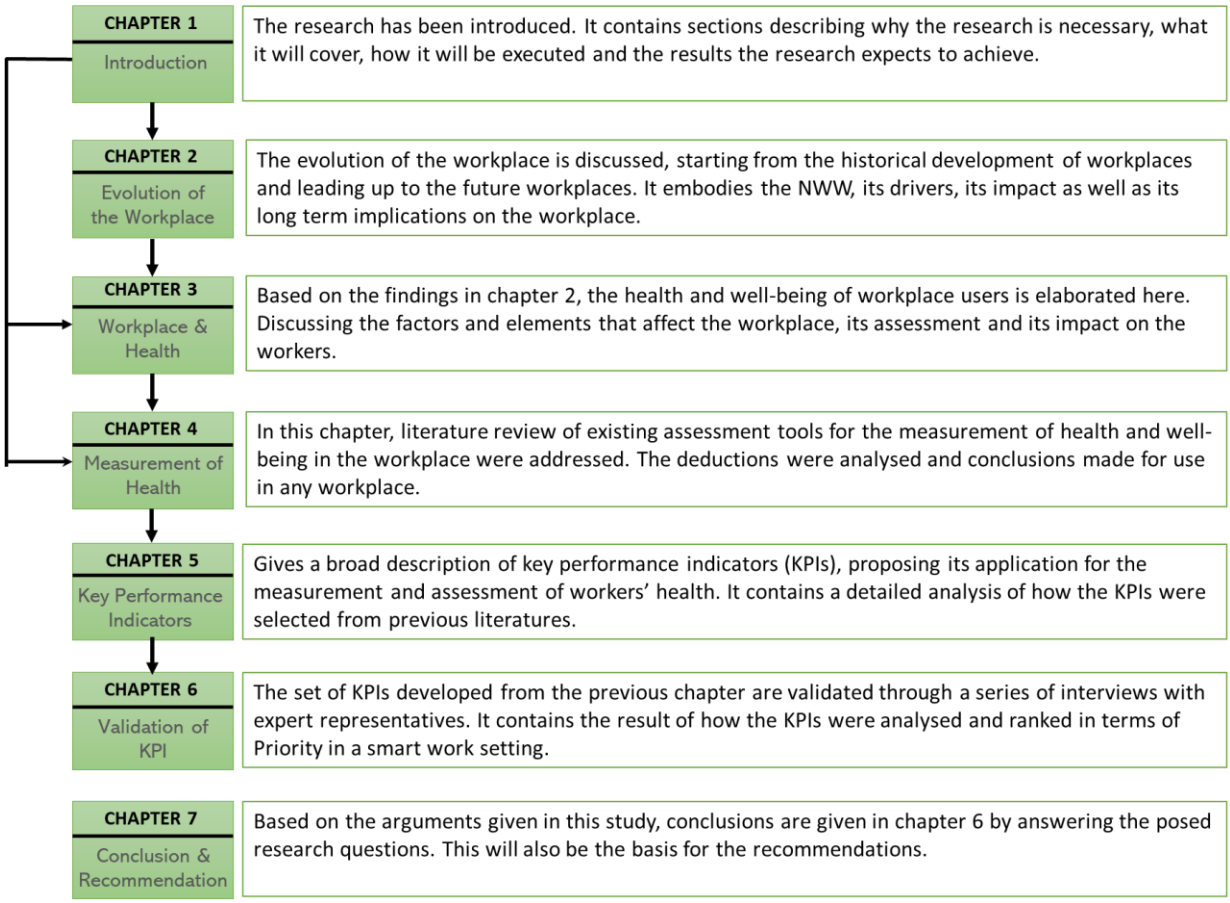

Figure 1: The Research Structure

Keywords: Healthy workplace, New Ways of Working, Key Performance Indicators, Indoor Environmental Quality, Health, Well-being

Chapter 2 – EVOLUTION OF THE WORKPLACE

This chapter describes the evolution of the workplace describing how the use of technology has changed the ways of working. It starts with the historical development of workplaces (section 2.1), which leads to the future of the workplace (section 2.2). Next is the flexible working arrangements (section 2.3) followed by an introduction to the New ways of working (section 2.4). The drivers for the adoption of NWW follows next (section 2.5), then by impacts of NWW (section 2.6). A representation of the chapter structure is shown in Figure 2.

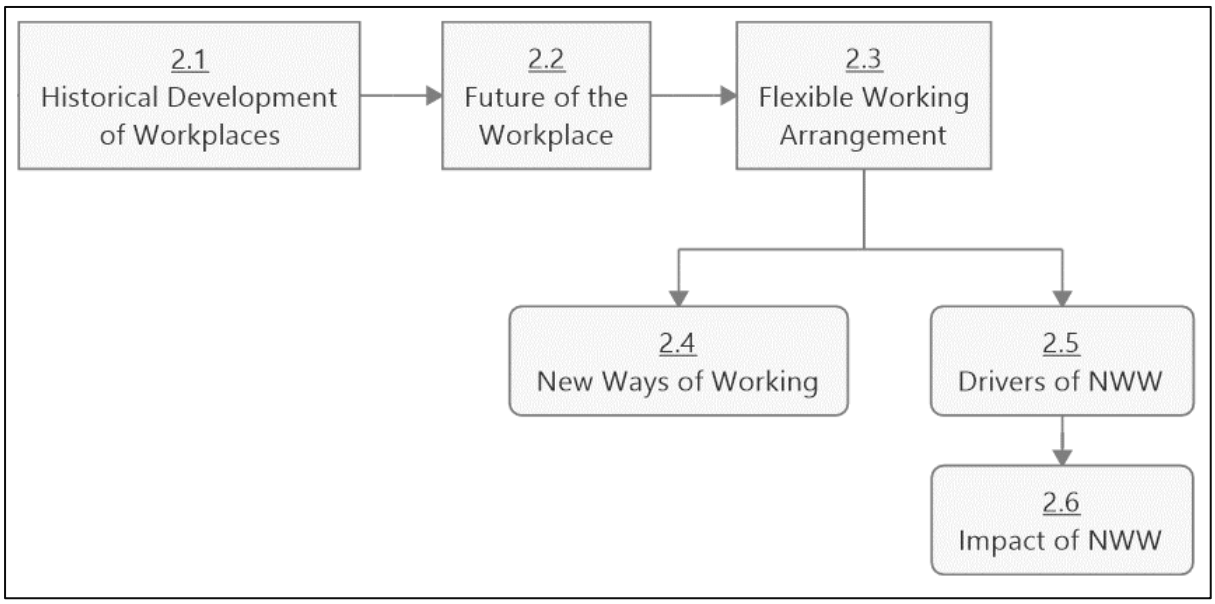

Figure 2: Structure of Chapter 2

2.1 HISTORICAL DEVELOPMENT OF THE WORKPLACE

The workplace as we know it has not always been like this. Multiple phases and accounts of history have recorded it to have undergone a series of transformations throughout time. The accounts of historical records on this transition share lots of similarities and key characteristics (Rainhorn and Bluma, 2013). The industrial revolution that commenced in the 19th century began the substitution of human efforts for machinery. It stood as the first step of transitioning of labour from handicraft to manufacture (Landes, 1969). The subsequent wave of the 20th century brought about the rapid transitioning of labour from manufacturing to the services industry. These drastic changes in the industries demanded a reform of the workplace to suit the needs of the emerging trends. As time progressed, the methods and manner of the workplace saw tremendous changes and with each change, there were associated risks (Le Roux, 2014).

From the year 1975, the total percentage of workers employed in the European common market countries had seen a decline of 20% whereas the workers in the service sector rather saw an increase of 22%. Irrespective of this decline, productivity in the manufacturing industries has elevated considerably compared to the services sector which remained nearly static (Worthington, 2012). Between the years 1980 - 1990, a considerable sum of resources was spent by companies in the automation of offices while only about 10% of those sums were spent in the manufacturing sectors. It did not end there, following up between 1990 – 2000, firms realised that in order to meet the ever-increasing technological demand, they would be required to repurpose where and how they work to stay competitive (Worthington, 2012). The regular replacement of old machinery with newer equipment was no longer helping, so they started to readapt the workplace and workforce even before the technology arrived so as to increase efficiency and productivity concurrently with the advancements (Worthington, 2012).

Technological transformations have occurred sporadically and a typical representation of the benefits of this change is how from the convenient of our homes we can now access banking services 24 hours in a day. It is now clear that as observed in the 1970s with the manufacturing sector, office work has gone through stages of restructuring (Worthington, 2012). Similarly, the service industry in advanced European countries spiralled to 60% of the working population. In the next phase of the knowledge-based workers, what percentage could we be possibly looking at?

A comprehensive account was made by Johns and Gratton (2013), showing three waves of change and how they have influenced the way of working. Workers have devised new arrangements for getting knowledge work done and thus three models of work organization, have been developed in the past four decades, reflecting changes in employee priorities, evolutions in employer demands and the emergence of new information and collaborative technologies.

1) The first wave was the advent of personal computers and e-mail which brought about freelancers, offering both workers and employers new flexibility.
2) Next, mobile technology and global teamwork gave the same kind of work-anywhere, work-anytime flexibility to full-time employees, without asking them to forsake career progress and development within their companies.
3) Currently, in the third wave, new ways of providing community and shared space are curing a side effect of virtualization; worker isolation and driving increased collaboration.

The first wave begot teleworking which dates back to the 1970s, when computer technology was introduced into our daily lives, transforming the worker's home into the second place of work. Over the years, this has progressed into numerous variations of teleworking, which often focus on

examining various relationships between the workspace and multiple locations used by a worker such as teleworking, on-site working, mobile working, home working, and so on. Thanks to the constant technological evolution and the awareness of potential social benefits, the need to change the telework paradigm with smart work is continually growing (Hislop and Axtell, 2009).

The second wave saw the evolution of teleworking into smart working. Specifically, working according to the smart philosophy means, for companies, managing the work of their employees in a completely different way (Hislop and Axtell, 2009). We no longer speak of a fixed location, but totally flexible and detached from a physical place. It is an innovative approach to the organization of work that enhances the flexibility and autonomy of spaces, schedules, tools in the face of greater responsibility for the results. Companies that use these work models want to increase productivity and improve people's well-being both in terms of work-life balance and in terms of motivation and organizational well-being. However, smart work is not always considered only in its positive aspects. In reality**,** we tend to minimize the side effects of this phenomenon such as isolation**;** in response to this problem, coworking spaces started to appear in huge numbers at the turn of the first and second decades of the 21st century.

This phenomenon can be considered as the third wave of changes to virtual work where workers are seeking opportunities for serendipity, creativity and networking, collaborative encounters, sharing of tacit knowledge to increase their social capital and avoid the problems of virtualization suffered in the first two surges (Magnolfi, Lindsay and Waber, 2014).

As stated by Foertsch and Cagnol (2002), the first coworking space offering five to eight desks for two days a week was opened in 2005 in San Francisco by the programmer Brad Neuberg. This was in response to the increasing unsocial business centres and the unproductive work life at a home office. The number of coworking space has been increasing over the years and according to Instant Offices, there are approximately 35,000 coworking spaces across the world (Amador, 2019). Coworking spaces are growing more and more in many cities precisely to limit the forms of alienation that can arise when working alone. This development is strengthened by perfecting available technologies and a wide possibility of cloud computing.

These changes in the workplace have been the driving force of social change as well. One may now ask, as society is undergoing another drastic social change in the form of technological advancement in the upcoming fourth industrial wave, there would definitely be associated risks. We can hence learn from history and plan ahead for the next phase of change in the workplace.

A large number of knowledge workers today have some form of office setting in a part of their home. Gradually the mobility of office technology is increasingly developing and, in the end, the office will simply be where you are. This is greatly increasing the number of people periodically working from home and at times on the trains to work or meetings (Worthington, 2012). To conclude here, we need to acknowledge now that the corporate assets are changing from buildings and infrastructure to people and networks. So, the major factor that affects people and makes them a liability rather than an asset is their health.

2.2 THE FUTURE WORKPLACE

2.2.1 Background

The concept that underlines a workplace as seen from the above has been seen as being relative to a particular moment in time. Researchers in the early days of the first wave envisioned a paperless office where all forms of work would require little to no printing. Today we are close to achieving that globally (White, 2012). This section seeks to address what management must expect in the future whiles giving positive recommendations on how companies can align themselves to the ever-increasing demand and transition. One real projection organization ought to be looking at are the prospects of the growing use of Artificial Intelligence (AI) and all of its associated technologies. This assertion makes it certain that the way knowledge workers operate is going to get more flexible and will rely extensively on training and retraining to apply these technologies or current jobs may become simplified as they are automated by the application of AI (Nankervis *et al.*, 2019).

2.2.2 Future Workplace Assets

Little is currently known with regards to how prepared our Human Resource managers are in terms of making sure all organizations have the most needed asset of the future which in this case is a highly efficient and productive knowledge worker. The second is the influx of cloud computing, AI and advanced web-based technologies (White, 2012).

The characteristics of work in the future has lots of transforming attributes with associated features such as intensification of work, long hours and a general loss of control in time. This tends to have a drastic fallback on the health and well-being of workers (Smeaton, Young and Spencer, 2007).

The rapid adoption of ICT has forced managers to consider how they will be able to deliver a digital workplace which provides a flawless user experience as they work from any point on the globe. Currently, there exists a growing interest amongst intranet managers into developing the corporate intranet as their digital workplace accessible by employees (White, 2012).

White (2012) concludes that our working day has changed considerably over the last few years. Our days are now full of interruptions from our devices in the form of emails, social media and virtual team applications. A combination of these multiple acts though serves to better connect us, we are more likely to be interrupted during work. One keen challenge to be observed in the future workplace is the fact that in an open-plan office, colleagues and superiors can quickly see whether a co-worker is in a situation where they can be interrupted, but in a virtual working environment that is not the case (Wyn, 2009). White (2012) further supports the fact that one may be interrupted every 4–11 minutes and that seldom are we able to work for more than ten minutes on a specific task without deliberately cutting ourselves off from all channels of communication, and in so doing running the risk of not being seen as a 'team player'

2.2.3 Managing the Future Workplace

Worker productivity is one of the most crucial factors of the future. How can management assess if the knowledge worker is being productive or not? White (2012) proposes a solution to management. He suggests that in evaluating their work, the productivity ought to be a function of the value that knowledge workers are able to add via their expertise and experience to base-line information. This value is considered to be the true measure of their productivity rather than measures such as the time taken to complete a procedure.

On a minute by minute basis management staff in many organizations toggle between being a manager to being a managed employee. This is a consequence of the fact that they need to cope with taking on a mentoring role, to participating in multiple projects and communities whiles at the same time working through the never-ending supply of emails (White, 2012). So clearly management is equally having their fair share of unintended interruptions at work. Knowledge workers usually classify their interruptions as Sequential multitasking which could be deceiving at times (Smeaton, Young and Spencer, 2007). Looking ahead in the future where knowledge becomes the main asset it is prudent that management finds ways to avoid interruptions. Organizations using the digital workplace in their smart working sectors may implement the following strategies to help in securing the work of knowledge workers to improve productivity.

- Organizations must ensure that the digital workplace is as simple and obvious as email or messaging.
- The smart working environment has to be contagious. It must have clear benefits to all parties involved. It needs to communicate effectively to all parties especially to distributed workers worldwide and the different enterprises that may interact with the organization.

- It must be cross-enterprise. The digital workplace must span company boundaries and geographic boundaries. It also must operate outside the corporate firewall with an organization's customers, suppliers and other partners, and require very little IT involvement, or it will not gain acceptance.
- The workplace has to be complete. Communication, document-sharing, issues-tracking, and all other decision- making needs to be captured and stored in one place (White, 2012).

Implementing the above strategy will effectively make all the efforts of knowledge workers fruitful and their day to day productivity evaluated.

Team working, performance-related pay and flexibility of hours are all good ways to maximise effort, motivation and productivity among employees. A lot of organisations have adopted a 'high-performance' work strategy. This form of high- performance approach has certain keen characteristics that organizations need to ensure their existence when pursuing productivity in the future. They include an active sense of team working, employee discretion, autonomy, upskilling and functional flexibility (characterised by an erosion of strict lines of demarcation between work tasks and job roles) (Smeaton, Young and Spencer, 2007).

Finally, the adoption of virtual employees by management in the near future will definitely reduce overhead costs needed in maintaining real estate assets and travel time of employees to work among others. Additionally, they would reduce management need to travel for training, eliminate the use of paper documents, and expand employment due to the virtual platform. Digital offices reduce energy use and other resources of staffing an office. Better management and adoption of virtual offices may lead to increased contributions toward improving the global environment (Allen, Golden and Shockley, 2015).

2.3 FLEXIBLE WORKING ARRANGEMENT (FWA)

For the purpose of examining flexible working-time arrangements, it is pertinent to observe them in relation to the regulatory system for standardised working hours. The was created by collective negotiations and statutory regulation and sought to cover the majority of the paid workforce in most industrialised countries by the middle of the twentieth century (Bosch, 2004). The regulatory system for standardised working hours consists of two main parts which include:

(A) A standard working time arrangement; and

(B) Provisions for deviation from the standard.

There has been a popular misconception that flexible working-time arrangement automatically deviates from the regulatory system of standardised working hours. Arguments like this can be said

to be true for more rigid practices such as part-time and shift work which are categorised outside the traditional working-time. However, flexible working-time do not fall outside the regulatory system of standardised working hours as provisions that allow employers to adjust from the standard have been incorporated. Case in point, rules for shift work and overtime permit for organisational needs such as continuous production in manufacturing, in emergency services, for safety and maintenance work to be met. In such cases, however, the rules allow for a compromise so that employees continue to be protected by imposing limits and requiring that the deviations from the standard should be compensated, planned, subject to agreement, safe and equitable (Berg, Bosch and Charest, 2014).

Flexible working is characterised by a very flexible nature in terms of both the workplace and the working hours. This gives the workers the opportunity to organise their working hours in synchronization with their personal life and family relationships. Flexible working hours are usually requested in order to align the working hours to meet the demands of either the employers or the employee for the overall productivity of the organization as well as improved well-being of employees and they thus, essentially convey the meaning of change and adaptation. The choice of flexible working hours can be influenced by the employees, employers or both. There is a degree of uncertainty around the terminology ‘flexible’ working hour as it has been classified as any kind of working hours that differ from the 'traditional' working hour, thus including fixed arrangements like compressed hours, shift working, part-time working which doesn’t necessarily provide for flexibility. It is, therefore, necessary to clarify exactly what is meant by flexible working in the context of this thesis. The SALTSA group on flexible working hours adopted a tentative definition as, “hours involving a continuous choice on behalf of employers, employees or both, regarding the amount and the temporal distribution of working hours” (Costa *et al.*, 2004).

This definition was further explained by Janssen and Nachreiner (2004) as implying vital factors of flexible working hours which include their variability in chronometry (e.g. by extending one’s working duration), their variability in chronological position (e.g. when deciding about the temporal position of on- and off-duty hours) and the impact the controlled working hours has on the employees and/or the employers. The concept of working time may seem straightforward, but it is difficult to find a rational definition of flexible working time owing to the fact that the request for flexibility of working-times is mainly gotten from the employees’ immediate need for satisfaction from an implicit contrast with rigidity (Campbell, 1993).

The discussion so far has centred on differentiating standard working-time from the flexible working-time arrangements but the task of differentiation needs to be expanded as we tend to focus more on flexible working time. Working time arrangements, whether standard or flexible, differ in their impact

according to the degree of employee control over the varied features of the working-time arrangement (Chung and Tijdens, 2013). With regard to the subject of flexibility, the pertinent question that seeks to be answered is 'to whom is the flexibility targeted at?' Key components of the above-mentioned definition of a flexible working hour are the facts that employers and employees both have a continuous option for choice to adapt the working hours to the needs at hand. That means that key components of flexibility are variability and control, with the degree of choice available to the parties involved. The answer generally comes down to either the employer or the worker. The most common way of denoting the division is in terms of 'employer-oriented flexibility' or 'employee-oriented flexibility' (Chung and Tijdens, 2013).

Employer-oriented flexibility cater to the organizational needs of employers, and is driven by the negotiated right to formulate a considerate extension (or reduction) of the working duration, without having to pay an extra charge while employee-oriented flexibility of working hours meets the ever-changing needs of employees in different stages of life pertaining to family, study, etc. responsibilities. Individual flexibility gives the employee more control as regards to starting and ending times as well as breaks, days off, and vacations. The possibility of choosing the duration of working hours in different stages of one's working life can also meet the needs of employees (Klindžić and Marić, 2019).

Clearly defining the distinction between employer-oriented and employee-oriented flexibility is indeed essential, but they should not be seen as two distinct but rather complementing phenomena which can allow for an overlap of interests meeting at the centre (Klindžić and Marić, 2019).

To throw more light on the concept of flexible working hours, Costa *et al.* (2004) further explains that there are two variables that describe the different forms of flexible working hours, namely; 'variability,' which is related to the possibility of not having the same number of hours every day, the same number of days every week, fixed starting and finishing times; and 'flexibility,' which defines the possibility of having some control over the working hours, to take breaks when desired, and to be free to decide when to take holidays or days off. In their paper, variability can be viewed as an index of less rigid working timetables, and synthesizes a form of flexible arrangement of working hours generally more subjected to company control and decision; whereas, flexibility can be seen as an index of an arrangement of working hours more connected to individual discretion and control. The two variables are neither directly nor inversely related to one other, but they appear to have a different impact on workers' health conditions (Costa *et al.,* 2004).

2.4 NEW WAYS OF WORKING

2.4.1 Background

From the evolution of the workplace, the ideology of working from home or from one's desired environment emerged in the 1970s. This era brought about the knowledge-based society where organizations were faced with a responsibility to become more customer centred. In response to these, organizations employed the use of information and communication technology (ICT) which were seen to have a significant influence on work-life as ICTs are developed in a way that digital information is available at any time and at many places (Spreitzer, Garrett and Bacevice, 2015; Blok *et al.*, 2011).

ICT may be described as communication, computer hardware, and computer software related to technology (Karoly *et al.*, 2004). Its arrival has facilitated significant changes in how work tasks are carried out, citing the use of the internet as an example, this has grown rapidly since its introduction in the 1990s (Lederer *et al.*, 2000). With these, organizations started to redesign their approach to work and this essentially allowed employees the opportunity to organize their work flexibly. Employees are expected to decide for themselves when they work (flextime), where they work (flexplace), and by which communication tool or medium (smartphone, email, and videoconference) they work (Demerouti *et al.*, 2014).

The continued rise of digitalization has led to the collapse of the old concept of work also known as the traditional 9-to-5 and to the rise of the concept of new ways of working (NWW) which is fast becoming the more preferred approach especially in some of the world's developing economies. NWW is perceived as an idea of flexibility in the workplace (McKendrick, 2012). NWW can be seen as an on-going development due to the continuous evolving of information technology and different expectations of the new generation of employees from the working environment of today and the future.

In the white paper on Digital workstyle, Microsoft (2005) explains how hard it can be for organization and people who work in them to adapt to these changes. The workforce is often faced with the challenge of learning new skills as well as adapting to new ways of working while organizations are faced with the responsibility to understand the forces driving change as well as their impact on people and implications for the workplace. In this environment, organizations will thrive to find new ways to equip information workers with tools that amplify their human talents, connecting them to an information infrastructure that allows them to understand their role, find and collaborate with the right people, and make the best use of available data in their decision-making and work activities.

According to Nijp *et al.* (2016), NWW is defined as “time and place-independent work, often combined with extensive use of ICT and performance-based management”. From this definition, it is evident that there is not one NWW type. Alternatively, NWW comes in many strengths, depending on the company's existing policies, ergonomic workplace design, and the availability and use of ICT.

Bijl and Gray (2011) describe NWW as “a vision for making work more effective, efficient, pleasurable and valuable for both the organisation and its employees”. This is achievable by giving employees space and freedom in how they work, where they work, when they work, what they work with and with whom they work.

Baane et al. (2010) also describes NWW as “time, and place independent working, focus on results, free access to information and flexible labour relations”. Expanding on this, NWW has three key characteristics. First, the timing of work has become more flexible as employees have more autonomy in deciding when they work. This implies that there are no fixed work schedules as was common in traditional 9 to 5 jobs. Secondly, NWW offers the employee various options for the place of work, including the office, home, and during commuting time.

These principles give employees maximum freedom on the basis of mutual trust. This trust is reflected in the way employees exercise autonomy over the mode, time and location in which to carry out their work tasks. Employees are then evaluated on the basis of their personal or team contribution to the result rather than their presence. Thus, Employees can engage in a working relationship that best suits their ambition, skills, lifestyle or stage of life (Baane et al., 2010, as cited in Kok, Koops and Helms, 2014)

Baane et al., (2011) further described NWW by distinguishing three integrated elements: Bricks, Bytes and Behaviour. Bricks concern real estate, housing and facilities where the work is being carried out. Offices are no longer a space to work, but should be seen as a meeting place. A design that is based around people, not desks. Space is set to be reborn as a creative place where people meet and collaborate (Stilman, 2018). Esfandiari, Zaid and Azzam Ismail (2017) studied the implementation of work environment design as an essential factor for employees’ perception and attitude. Bytes refer to IT technology, hardware and software used to perform the task. A laptop, tablet or another device with an Internet connection, allows an employee to work outside the office including their home (Gurstein, 1996). Lastly, the behaviour is about the human factor and the organisation itself. It covers employee well-being and knowledge work (Blok *et al.*, 2012b; Demerouti *et al.*, 2014). In order to provide a comprehensive view of NWW, all organisations working to implement NWW need to take into account all three Bs when designing the work settings and practices of a workplace. (Baane et al., (2011) as cited in van Diermen and Beltman, 2016).

There have been several attempts by researchers to define NWW. However, all of which agrees with the underlying fact that it is 'working at any time and from any place' (Nijp *et al.*, 2016).

Thus, for the purpose of this research, we shall adopt Nijp *et al.* (2016) definition of NWW as our research focuses on smart working and coworking which will be extensively discussed below. This definition was chosen as it emphasises the use of ICT in the concept of NWW which is very crucial for employees engaging in smart working and coworking.

Types of New ways of Working

In modern organizations, NWW has been classified in diverse number of practices. Moll, (2015) gives an example with a non-exhaustive list. An observation from the description shows that all the NWW practices listed make use of ICTs and are characterised by their ability to be performed both in and out of the employer premises. Therefore, in subsequent sections of this research, the practices listed below (Table 1) will be condensed and classified as 'smart working and coworking'. These will be given a detailed explanation in the next sections.

Table 1: NWW Practices (Moll, 2015)

NWW Practices	
NWW Practice	Description
Teleworking	Doing the work (partly) from home or elsewhere outside of the organization
Satellite Offices	Part of teleworking - Offices outside an organization´s office buildings, e.g. at customer´s locations or shared workspaces with other organizations
Mobile Working	Part of teleworking - Enabling employees to work while commuting
Flexible Workspaces	Flexible workspaces in the office building that are shared among employees and offer diverse working environments that correspond to the various tasks in order to facilitate effective working
Flexible Working Hours	Allowing to start and end the workday outside of the core time and having a say in determining one´s workdays
Freedom in Choice of Tools	Employees can choose themselves from a variety of digital tools to share, collaborate and work remotely
ICT Support - Communication Tools	Using smartphones and other mobile devices to enable digital collaboration and document sharing (via e.g. work-mail at home, Chat-applications, DropBox or Lync)
ICT Support - Communication Tools	Using smartphones and other mobile devices to allow employees to stay digitally connected and collaborate via e.g. internal social media applications such as "Facebook at Work" or specialized and tailor-made social forums

2.4.2 Coworking Spaces

From facts already established in this literature, the term ‘coworking’ refers to the practice of working alongside one another in flexible, shared work settings where desks can be leased on a daily, weekly or monthly basis. Therefore, coworking spaces are designated locations created to facilitate this kind of work (Foertsch and Cagnol, 2002). However, it can be argued that every form of labour alongside colleagues could be described as coworking, and organizations could, therefore, be described as coworking spaces as well (Merkel, 2015). Regardless of this origin and application, coworking spaces have been attracting attention as spaces that provide a more flexible work style compared to those working in a corporate office (Bueno, Rodríguez-Baltanás and Gallego, 2018).

Merkel (2015) also described coworking as a new urban social practice that characterizes new ways of organizing labour and helps freelancers to support each other. Coworking spaces, which are flexibly cost-effective and community-oriented workplaces, promote meetings, collaboration and constructive exchange between diverse job, practice and cultures.

From Baane et al., (2010) concept of ‘anytime, anywhere’ earlier discussed, Tony Bacigalupo, an advocate of the coworking movement points out a challenge which poses:

"The Irony of being able to work anywhere is that there isn't anywhere designed for people who can work anywhere, so a movement formed around that and that is the coworking movement." (Tony Bacigalupo, as cited in Jackson, 2014)

This is cited as a common reason why people opt for coworking spaces as an alternative option to working from a home office so as to avoid the isolation and discomfort of working alone and juggling work, leisure and the family life all at the same time. By using a coworking space, they create a structured day at the office and are able to separate their work-life from their private lives, allowing them to balance both and be more productive (Warhurst *et al.*, 2008).

According to Spinuzzi (2012), coworking refers to a co-localization of a group of people with more or less heterogeneous backgrounds in the same workspace. Co-working spaces share similar aims by being located near the everyday activities of their users. Therefore, these spaces are typically close to users' homes, clients or desirable amenities, such as day-care centres, popular bars and restaurants or in rapidly gentrifying areas near downtowns and major transportation hubs. This explains it as a spatial solution. In addition, co-working spaces are typically flexible in terms of office hours (Spinuzzi, 2012). Van Meel and Vos, (2001) asserts that new offices no longer look like offices, but are transparent, open, playful spaces with an identity. The objectives of these workplaces are to increase productivity, flexibility, creativity and interaction and to reduce costs as well as environmental impact.

Another driver of coworking spaces is attributed to the rise of ICTs as a growing number of remote workers, employees working from home, project-based freelancers, and self-employed persons prefer to patronise well-equipped coworking spaces (Jorgenson and Vu, 2016). This is seen as a strategy for compensating the loss of social contact with colleagues as one core feature of a coworking space is fostering a collaborative environment. Hence, coworking is not just about working alongside others in a flexible and most at times affordable office space. It also promotes five values: community, collaboration, openness, diversity, and sustainability. This collaboration is a way of tapping into new ideas. Spreitzer, Garrett and Bacevice (2015) conducted a study which showed that the most common motivations to embark on a collaboration based on coworking spaces are the opportunities derived from interactions with people, random discoveries and opportunities and knowledge sharing.
For the scope of this research study, we will describe coworking spaces as components of 'new ways of working' because they vary in their short-term letting of desks from older models of shared office space and thus their flexibility and mobility are constantly changing the social composition.

2.4.3 Smart working

With globalization, the way people work has changed over time. The advancing and efficient use of ICTs have seen the flexible working options transcend from the era of 'teleworking' to 'smart working'. Space savings have been cited by Tagliaro and Ciaramella (2016) as one of the reasons why this new way of working is on the rise.

Although smart working is fast becoming common, there has been no structured definition for it. Previous works of literature offer various interpretations of the concept of smart working, each emphasizing on the different characteristics of this phenomenon. Smart working is generally characterised by very flexible nature both in terms of workplace and working hours and it gives the workers the opportunity to organise their working hours in conjunction with their private life, family and friend relationships.

The Smart Working Observatory formed in 2012 concerned with studying changes as to how people work defined smart working as "a new management philosophy founded on a return to people being given flexibility and autonomy in choosing their spaces, their working times and the tools they use, against a backdrop of taking more responsibility for the outcome" (Corso and Crespi, 2012). According to the latest report issued by the Smart Working Observatory of the Politecnico di Milano, the number of workers in Italy who can choose how to organise their work independently keeps increasing, reaching 480, 000 and smart workers feel more motivated and satisfied than other workers (Corso and Crespi, 2018).

Smart Working, as set out in the British Standard Institution's (BSI) Smart Working – Code of Practice, is the generic term used to describe the changes needed to modernise working practices in a dynamic and business-focused way (El-Gamry and Heselwood, 2008). This explains how it helps to streamline business processes to improve customer service and the experience of staff members by changing its working culture, transforming its use of space and implementing new technologies.

According to UK Chartered Institute of Personnel and Development, it is an "approach to organising work that aims to drive greater efficiency and effectiveness in achieving job outcomes through a combination of flexibility, autonomy and collaboration, in parallel with optimising tools and working environments for employees" (Zheltoukhova, 2014). This definition encompasses the whole essence of smart working for improved innovation, productivity and employee satisfaction.

Smart working may sound like coworking as it entails flexibility on how work can be carried out and also the use of ICTs, but the distinguishing factor is that smart working is a model of team management, where the emphasis is on results, not the physical presence at the desk and the number of hours worked.

Smart working is also a way to manage a team by encouraging creativity, unlocking energy reserves and unleashing its full potential. This is achieved by offering employees freedom of choice as to how and where they work (Von Krogh *et al.*, 2000). With this ideology of the concept of smart working, a lot more people can work.

From the reviewed literature, we deduced that smart work can also take place in an office. Smart offices are characterised by monitoring, prediction, autonomy and adaptation features (Das, 2007), it also has the capabilities to communicate with humans in a natural way. These refer to Perceptual User Interfaces (PUI) that are not based on a keyboard and mouse as input interface but based on human actions like speech, gesture, interaction with an object, etc. (Ramos *et al.*, 2010).

2.5 DRIVERS FOR THE ADOPTION OF NWW

For a number of reasons, NWW is considered beneficial for both the employer and employee. One of which Shagvaliyeva and Yazdanifard (2014) identified is the improvement in work-life balance as it causes a significant reduction in time spent on commuting which can be used for other non-work responsibilities. This reduction also leads to a further reduction in traffic congestion, carbon emission and energy use (Brown, 2017). Other benefits include smaller office space and its associated cost (van der Voordt, 2004), increased productivity (Bueno, Rodríguez-Baltanás and Gallego, 2018), better communication and collaboration among workers (Spreitzer, Garrett and Bacevice, 2015). NWW has also been observed to foster social and cultural development as it can build employment

opportunities, attract and retain skilled workers and can potentially stimulate economic growth in remote areas via virtual interaction. Table2 highlights these drivers explaining how participation in smart working and coworking can be of benefit to the society at large.

*Table 2: Drivers for the adoption of **NWW***

Drivers of New Ways of Working (NWW)		
Drivers	Description	
	Coworking	Smart working
Work-life balance	Coworking facilitates a work-life balance as they are typically located close to users or desirable amenities so as to reduce the time spent on commuting.	Smart working allows employees the flexibility of when and where to work. This creates a balance in fulfilling their working as well as non-working responsibilities which leads to job satisfaction.
Productivity	Coworking spaces are well-designed environments with proper layout, furnishings and décor that guarantees job satisfaction leading to higher productivity.	Smart working as an opportunity to optimise how they use their time and increase their company's productivity.
Sustainability	Coworking spaces pride themselves on providing their co-workers with assets to help them grow their business and also instil a culture of equally giving back what you receive.	Employees who engage in smart working do not use transportation and thereby reduces carbon emission.
Social and cultural development	Coworking spaces can be regarded as a new form of urban social infrastructure that encourages collaborations between people, ideas and places.	Smart working fosters social and cultural interactions as employees can hold meetings with colleagues from any part of the world virtually. Smart offices are also designed to enhance the social lives of employees.
Communication, interaction and collaboration	Coworking is mainly seen as a perfect mix of intellectuals with creative and problem-solving skills that can interact to share knowledge.	ICTs have revolutionized how we perform tasks; as smart workers, we can now access, send and receive emails, join meetings from anywhere.
Cost-effectiveness and Efficiency	Coworking spaces alleviate much of the costs associated with managing an office since it somewhat operates a pay as you go system.	Companies whose workers engage in smart working enjoy lower rent due to fewer workspaces and a smaller overall working area; and lower operational costs of the office.

These drivers appear to be incomplete as it is lacking in the area of health. This is very important as fostering employee health and well-being is good for the people and the organization. Therefore, the question regarding NWW and its potential benefit on workers' health and well-being begs to be answered.

2.6 IMPACT OF NWW ON EMPLOYEE HEALTH AND WELL-BEING

According to Costa *et al.* (2004), the continuous change of the demography of working population has led to the need for reconciliation between work and care commitments as this can have adverse effects both on employees and employer. NWW characterised by flexible working practices have been recognised as an important means of balancing this relationship out as it refers to the flexibility regarding an employee's work location, working times and how much an employee works.

Based on the current state of research on this topic, it is difficult to reach definitive conclusions about the effects of NWW on the world of work as it does not have a universal modus operandi. This is because studies are not carried out on a scale that could provide sufficient basis for general conclusions and so it varies according to the laws of the countries it is being operated in, the sector of the industry, social status as well as the gender of the employee (Costa *et al.*, 2004). Nonetheless, the literature findings provided in this section can provide some comparative evidence regarding the impacts of NWW on workers' health and well-being despite the lack of readily available empirical research on this topic.

These impacts are presented in the following dimensions of work that can affect workers' health and well-being: working time, work-life balance and occupational health and well-being.

Working time

The impact of NWW on the working time of workers involved in such arrangements is viewed in terms of both the work duration and the organisation of the working time. The potential for improvements in the duration of working hours and diversification in the organisation of working time is greater among employees engaged in NWW than for other workers because ICT helps people to organize work more flexibly and allow work to be done at any time and at any place

Positive impacts: According to Popma (2013), one benefit of place and time autonomy in the workplace is that it allows employees the ability to have more flexibility over the management of their work time. For example, employees who combine work and care duties can find a balance by taking care of their dependents during the day and then catch up on the lost hours at night.

Another positive reason for the long working hours in NWW is the increased capacity it gives workers to perform work, irrespective of the location. Lasfargue and Fauconnier (2015) reported that a survey of 406 smart workers in France was carried out by independent research institute OBERGO, and 61% of the respondents stated that their working time has increased. This report also found that the reason for such a rise is the decreased time spent on commuting to and from work. The reduced travel time is therefore spent on working in the morning. Hence, making travel time work time.

Negative impacts: The Third EU Survey on working conditions reported that longer and irregular working hours are linked to a lower level of occupational health and well-being. An investigation of home working reveals that it is associated with working longer hours which appears to cause an invasion of work into family time and maybe justifiably considered as a form of work augmentation (Paoli and Merllié, 2001).

Firstly, there is the risk that some employees in a bid to make up for lost time during the day will work late into the night thereby reducing their rest time or for some workaholics, they will simply work too many hours since they in total control of their working hours. Paridon and Cosmar (2009) supports this assertion with an online survey involving more than 200 participants showing that one-third of workers found the relationship between work and private life problematic.

Secondly, a negative effect of NWW is its tendency to be a supplemental addition to working hours which is often informal and unpaid. It's been generally observed that workers engaged in NWW tend to work longer than other workers. These extended working hours are difficult to estimate as much of the hours appear to be spent over normal working hours but outside of the formal arrangements.

Work-life balance

The literature dealing with the relationship between using ICT to perform work outside the employer's premises and recorded work-life balance expectations is complex. Depending on certain factors, the relationship between NWW and work-life balance may be either positive or negative. Some of the issues the literature has raised include: organizational autonomy, longer working hours and the feeling of constant availability for work, role ambiguity and the blurring of the boundary between paid work and personal life.

Positive impacts: Tipping *et al.* (2012) report provide findings of a work-life balance employee survey where researchers found that workers agree flexible work practices boost the morale of the workplace, which could have a positive effect on work-life balance. Pryne, Powell and Parsons (2012) in their report intended to be a practical guide to the actual process of developing and implementing an employee well-being strategy, also states that flexible working is one of the best activities to increase employee well-being mainly because of the reduction in commuting time and the autonomy to organise working time based on individual workers' needs and preferences. According to Hyman *et al.* (2013) analysis, high-stress jobs such as call centre workers and software developers working from home were considered to reduce work pressure as they are allowed to control their individual workload more flexibly. Shagvaliyeva and Yazdanifard (2014) further explains that this definitely contributes to improvement in the allocation of work and life responsibilities. Thus, employee might end up fulfilling his/her work as well non-work roles easily. This successful achievement of the work

and non-work responsibilities leads to finding work-life balance, which increase overall life satisfaction of the employee. A few illustrative examples are presented below.

Lasfargue and Fauconnier (2015), where respondents used time saved by not commuting to work to spend with family (79%), for personal activities (66%) or for local community activities (47%). Accordingly, 95% of respondents also claimed that telework had a positive impact on their quality of life at work and beyond; 89% registered a higher quality of family life; 88% expected a better work-life balance.

Similarly, a study by Accenture Global Research of 4,100 US business executives showed more than three-quarters of them (77%) agreeing that technology-enabled them to be more flexible with their schedules, and around 80% cited flexibility in their schedules as being extremely or very important for balancing work and personal life (IWD_Survey, 2013).

Negative impacts: As NWW have been confirmed to improve work-life balance, there is also the risk of interference between work and family life because of longer working hours and the mix of duties at the same time, which may result in blurring work-life boundaries and increased work-life conflict. Sparks, Faragher and Cooper (2001) in their investigation of flexible work practices discovered that NWW is associated with greater levels of both working pressure and work-life conflict. This finding, however, cannot be extrapolated to its effect on work-life conflict as the workers are at a risk of work encroaching into their family life thereby making it harder for employees to 'leave work where it belongs, at work'. Therefore, working at home may increase work-life conflict.

In the UK, Harris (2003) cites the example of the lack of clear boundaries leading to confusion for the employee and their personal lives, with the result that the working day in effect becomes spread out over a longer period. Ironically, this study notes that the issue of boundary is challenging both for managers and employees, as it is sometimes ambiguous when employees are at work and not at work. The study found that more than four out of 10 mobile workers experienced an increasingly blurred line between work and private life, compared with two out of 10 in the case of non-mobile workers. Such findings suggest that unplanned flexible work schedules actually contributes to family life infringement. According to this Ojala (2011), working unpaid overtime at home increases feelings of guilt about neglecting home issues, and employees doing informal overtime work at home are more likely to report that work disrupts family life.

Researchers have gradually changed their approach to studying this subject because of this ambiguity and have started to ask how and not if NWW can be useful in balancing paid work and family life. An ideal individual approach for boundary management is key to a positive work-life balance. Therefore,

a suitable combination of boundary management strategies between segmentation and integration of paid work and personal life is therefore critical at the individual level (Clark, 2000).

Occupational health and well-being

Literature research and surveys discussed earlier (section 2.6) shows that working time and work-life balance are associated with occupational health and well-being. Therefore, it is expected that performing work outside the employer's premises with ICT will also have direct effects on the health and well-being of workers (Goudswaard *et al.*, 2012).

Positive impacts: Lasfargue and Fauconnier (2015) survey from France points out that reduced commuting as a consequence of NWW can be a source of diminished levels of stress and can also lower levels of fatigue the worker encounters. In this context, workers engagement in NWW would not only provide health benefits to those individuals who telecommute but would also have a broader positive impact on traffic congestion and on the healthiness of the environment.

According to Park, Fritz and Jex (2011), employees engaged in NWW tend to be happy, healthy, experience less work-life conflict and less stress if they have substantial control of their work schedule and can be able to detach from work during non-work time.

A recent study on mental health in the UK reports that over 39% of the people surveyed who work flexibly see a noticeable improvement in their mental health. Similarly, almost 43% of people who do not have the option of flexible working, feel it would enable them to better manage their mental health (*The 2019 Flexible Working Survey | Wildgoose Workplace Insights*).

Negative impacts: Karasek (1979) hypothesised that jobs with high levels of demand (for example, a heavy workload) coupled with low levels of control were associated with increased exposure to stress and negative health effects. This includes highly irregular and long work schedules which are mostly conducted remotely with the use of ICTs. The growing dependence on information technology in the workplace has resulted in many employees spending long hours at computer terminals. According to Popma, (2013), the use of ICTs presents an unwelcome form of techno-invasion where the boundary between work and private life disappears and the workers never mentally escape from work which in turn have a negative impact on their health and well-being. Studies have also shown that prolonged work using Internet-connected computers and mobile phones, can impact negatively on employee and lead to impairments in health and well-being, in terms of musculoskeletal problems, burnout, and visual discomfort (Berkowsky, 2013; Demerouti *et al.*, 2014; Ninaus *et al.*, 2015).

According to Paridon and Cosmar (2009), social isolation is associated with working away from the company premises thereby having fewer opportunities to seek support from supervisors and co-

workers. While this in itself may not be a problem, it could suggest that workers are more at risk of certain psychological issues associated with feelings of isolation. Social support has been found to serve as a buffer in the relationship between work-related stress and the development of mental and physical disease so a lack of such support might result in a higher susceptibility to illness.

Janssen and Nachreiner (2004) in their study on health and psychosocial well-being of flexible working hours found that high variability of working hours is associated with increased impairments in health and well-being and this is especially true if this variability is company controlled.

Hellebuyck *et al.* (2017) reports the findings of a survey on the effect on workplace stress. It recorded 57%, 56%, and 50% for Executives, Mid-level and Frontline employees respectively who stated that job stress regularly affected their personal relationships. Higher percentages for Executive and Mid-level may be reflective of greater work responsibilities and time commitments associated with their supervisory responsibilities.

There have been a number of studies reporting both the positive and negative impacts of NWW in the context of workplace health and well-being which more or less balances each other out, as identified through research above. It is difficult to determine whether the variations among these results occur due to the differences in the work culture of different countries. However, in order to design a flexible work system that balances the expectations of both the employer and employee, companies seeking to adopt NWW need to properly investigate the positive and negative impacts it will have on the health and well-being of its worker and take preventive measures in accordance to the law to protect employee health and well-being as well as cover the organization against any potential legal action from an injured or dissatisfied employee.

A comparative elaboration of the above-mentioned impacts of NWW derived from works of literature and surveys is presented below (Tables 3 & 4).

Table 3: Impacts of NWW on health and well-being

Dimensions of work that affect health and well-being	Positive Impact	Negative Impact
Working time: Working hour, working time autonomy, worktime organization	Better management of workers' time to combine work and care duties.	Extended working hours which causes an invasion of work into family time.
	Increased capacity to perform work irrespective of location.	Workaholics engage in late-night work to make up for lost time during the day.
	The decrease in time spent in commuting is spent on working.	Longer and irregular working hours which are often informal and unpaid.
	Discretion to determine work schedules and pace of work.	Excessive workload is borne out of high expectations as a result of employee control.
Work-life balance: Job satisfaction, working pressure, work-life conflict	Work is carried out during the hours that best fit workers' energy cycles which boost morale thereby improves mental health.	Engagement in informal overtime work is more likely to report disrupt family life.
	Reduced work pressure as workers is allowed to control their individual workload more flexibly.	Interference between work and family life may result in blurring work-life boundaries.
	Better balance between work, family and social life as since work is organised according to worker's needs and preference.	Working from home may mislead family about employee availability.
Occupational health & safety: Health impairments, Burnout, Stress, Fatigue, Isolation	Reduced commuting could decrease stress levels and lower levels of fatigue the worker encounters.	Prolonged use of ICT gadgets can negatively impact the worker leading to health impairments such as musculoskeletal problems and visual discomfort.
	Less traffic congestion improves the healthiness of the environment.	Techno-invasion blurs the boundary between work and private life as workers never mentally escape from work which can lead to fatigue.
		Overloading employees with work during long periods of time without providing sufficient recuperation can lead to burnout.
		Lack of social support as a result of isolation can lead to mental disorders.

Table 4: Survey from literature sources

Survey	Source	Year conducted	Country	Respondent population	Result
Psychosocial Impact of Mobile Telework: Results from an Online Survey	(Paridon and Cosmar, 2009)	2009	Germany	> 200 mobile workers	Used devices, ergonomic and health aspects: 80% adopt an uncomfortable position to use the devices; 18% have sufficient leg and foot room to change position; 45% can adjust their seats and 20% cannot; 20% seat have an adjustable armrest and 40% does not.
					Work organisation: 77% organize working time flexibly; 95% have high degree of control over their own actions and decisions; 12 % get work information and 40 % are not well informed; 55% never or sometimes face blurring of boundaries between work and private life; 60% always or often have to be available; 26% often or always complete tasks without being interrupted.

Survey	Source	Year conducted	Country	Respondent population	Result
Télétravail salarié: Comment concilier liens de subordination et marges de liberté? [Employees teleworking: How can subordination links and margins of freedom be reconciled?]	(Lasfargue and Fauconnier, 2015)	2015	France	406 employees	Better quality of personal life (work + outside work): 94% and 95% for women and men respectively Better quality of family life: 90% and 89% for women and men respectively The best distribution of professional/social/ family / personal time: 88% (time saved from not commuting accounts for this) Reduced stress and physical fatigue related to transportation: 87% Increased working time: 61% (morning commute time "exchanged" for work time) Increase in personal costs related to professional activity: 27% Increased workload felt: 15%
EMPLOYMENT RELATIONS RESEARCH SERIES 122 - The fourth work-life balance employee survey	(Tipping et al. 2012)	2011	UK	2,767 employees	75% of all employees, 73% of employees with non-childcare caring responsibilities and 79% of parents, rising to 82% for parents of young children were aware of the right to request flexible working. 90% of employee agree having control of work schedule improves morale , although over one third (35%) thought that people who work flexibly create more work for others; The availability of flexible working was important for just over two in five employees (41%) when they made their decision to work for their current employer. 3 out of every 10 parent employees reported some disruption to their working time due to child illness in the last three months. This was most commonly dealt with by taking leave (47%), followed by working flexibly (30%); 17% of those without a flexible working arrangement was able to respond to their child's illness by working flexibly.
Defining Success: 2013 Accenture Global Research Results	(IWD_Survey, 2013)	2012	USA	4,100 business executives across 33 countries	Work-life balance: 52% say they have turned down a job due to concerns about its impact on work-life balance; Work-life balance tops respondents' definitions of career success, ahead of money, recognition and autonomy (cited by 56%, 46%, 42% and 42% respectively) Flexible Schedule: 78% agree technology enables them to be more flexible with their schedules; 80% report that having flexibility in their work schedule is very important to work-life balance Personal life: 70% say technology brings work into their personal lives
Mind the Workplace - MHA Workplace Health Survey 2017	(Hellebuyck *et al.,*2017).	2015 - 2017	USA	17,000 employees across 19 industries	Work-family conflict: 81% stated that work stress affected their personal relationships and 19% stated it rarely or never did. Mental and physical health: 63% reported that their workplace stress resulted in a significant impact on their mental and behavioural health and 37% reported that it rarely or never did. Workplace stress: The effect on workplace stress was felt across all ranks with 57%, 56%, and 50% for Executive, Mid-level and Frontline employees respectively

Survey	Source	Year conducted	Country	Respondent population	Result
(The 2019 Flexible Working Survey | Wildgoose Workplace Insights)	Wildgoose Team	2019	UK	Employees from 114 companies	Work-life balance: Over 60% of respondents feel the regular 9-5 no longer works for them as they try to balance life in and out of work Mental health: Over 39% of respondents who work flexibly see a noticeable improvement in their mental health; Almost 43% of people who do not have the option of flexible working, feel it would enable them to better manage their mental health. Parenting: 68% of parents (who can work flexibly) feel it's vitally important in helping them to juggle both work and family life; 73% of parents vs 67% of non-parents indicating that this style of working is both essential for them to juggle life in and out of the office.

Structure of the Present Workplace

The workplace is represented by different terminologies in diverse categories. For the purpose of this study, Figure 3 below represents the various subcategories of the workplace. Presently, the workplace may have either of the two kinds of workplace be it a Traditional office or a Flexible working arrangement. Under the Flexible Working arrangement, a further subcategory known as New Ways of Working exists. The new ways of working introduce the two forms of workplaces this study seeks to addresses. As such, the Coworking and Smart working subcategories fall under NWW. Other flexible working arrangements may exist but not all these arrangements fall under NWW.

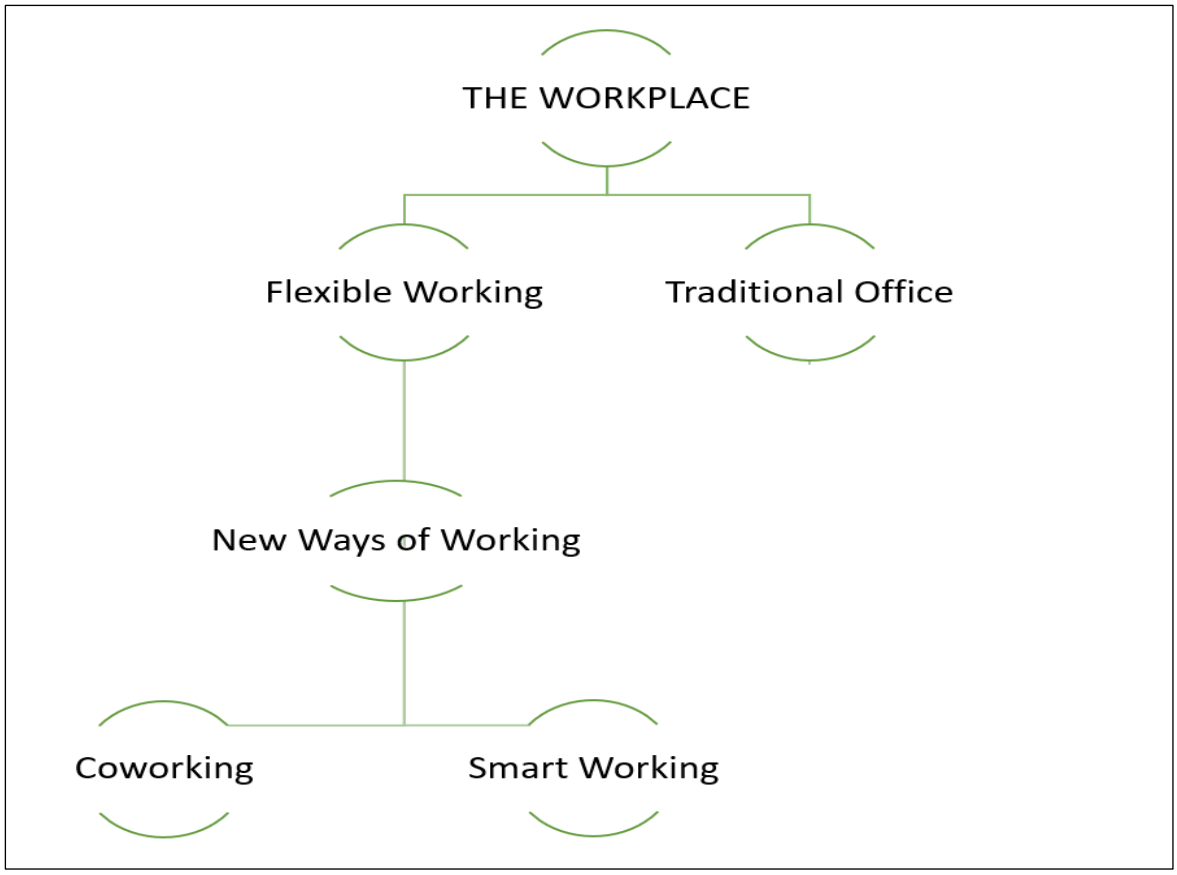

Figure 3: Scheme of the Selected Workplace

Conclusion on Literature Review of the Workplace

This chapter discussed how the new ways of working came to be. It came as a result of the technological improvements and the need for workers' flexibility in how, where and when they carry out their jobs. Highlighting the possible benefits that serve as drivers, the impacts were also discussed. Based on these findings, the health and well-being of workers will be discussed in the next chapter.

Chapter 3 - THE WORKPLACE AND HEALTH

This chapter describes health and well-being as it concerns the workers engaged in new ways of working. It starts with definition of terms (section 3.1), followed by the roles regulatory bodies play in protecting health and well-being (section 3.2). This was followed by explaining what makes a workplace healthy (section 3.3). Then, the elements that affect health and well-being in the workplace follows (section 3.4) as represented in Figure 4 below.

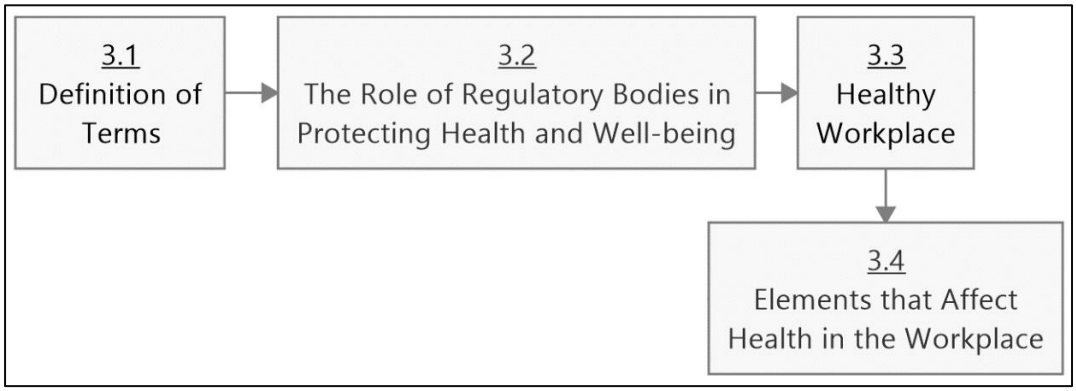

Figure 4: Structure of Chapter 3

3.1 DEFINITION OF TERMS

3.1.1 Health

There is a considerable vast amount of literature on different definitions of health where experts from a variety of disciplines have proposed alternative definitions of health, and we will discuss some of them before choosing the most suitable for our research topic. The Constitution of the World Health Organization (WHO), which was entered into force on April 7, 1948, defined health "as a state of complete physical, mental and social well-being". However, this definition was later revised as the writers of the constitution saw health as a state which is dependent on the presence or absence of diseases and added that an individual should not suffer from any form of a disease in order to be considered healthy. In that way, the definition of the WHO added to its initial stand, a requirement that allowed to consider someone healthy if no disease could be found and the step forward that could have been taken in the conceptualization of health as a dimension of existence which can co-exist with the presence of a disease or impairment was thus not taken (Jimenez Diaz, 1961). WHO new definition of health is thus, "a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity"(WHO, 1948). This generally accepted definition of health has however been criticised by some experts as having a number of limitations.

Boorse (1997) in his attempt to redefine health in order to cover up for the shortcoming of operationalization employed a statistical approach. He explains “health as the absence of disease” and “disease as a type of internal state, which is either an impairment of normal functional ability, i.e. a reduction of one or more functional abilities below typical efficiency, or a limitation of functional ability caused by environmental agents”. He proposed that statistical reference values are calculated for all possible human functions and results within the 95 per cent range would represent normal health, and results that fall outside this range would signify disease. This definition was promoted for solving the limitation of measurability as it is quantifiable and not relying on value judgments. However, there is an obvious deficiency as it lacks a connection with the robustness and peculiarity of individual health experiences.

Nordenfelt (2007) in his book proposed a standardization that “In order to qualify as a healthy person someone must have the ability, given standard or reasonable circumstances, to reach the person's set of vital goals” His analogy seeks to create an equilibrium between abilities and goals. Unfortunately, when considering human’s available needs and resources, it is hard to distinguish what makes up standard circumstances and vital goals.

In 2011, some experts presented a critique of the WHO definition of health where they highlighted its limitations as; the static nature of the definition, the changing patterns of morbidity and the operationalization of the definition as it is neither operational nor measurable. Huber *et al.* (2011) recommended that a definition of health should include “the resilience or capacity to cope, maintain and restore one's integrity, equilibrium, and sense of well-being” and therefore introduced a new concept of health as ‘The ability to adapt and to self-manage, in the face of social, physical and emotional challenges’. This definition may try to solve some pitfalls of the WHO definition, as it emphasises the resilience of people to cope with chronic disease. From this perspective, people can, therefore, be considered as healthy even while living with chronic disease. This projects more the capacity of individuals and the opportunities that are available to them rather than focusing on their disabilities. However, Jambroes *et al.* (2016) wrote about some limitations associated with this concept of health in relation to public health. The remarks about this emphasized the risk of reactive instead of proactive actions for health by individuals and professionals since challenges to be faced in life are unforeseen. Other concerns were raised about it being only applicable in circumstances that are within one’s control, whereas some social determinants of health may hinder the individuals and communities from adapting to their circumstances. This clearly shows that there is a need for an integration of public health and Occupational health and safety (OHS) as this will improve the health of workers. Already existing public health programs and networks can serve as important points of access for reaching workers with information about health and safety risks, prevention strategies,

occupational health services, and legal rights. These strategies can be beneficial in two ways whereby health departments will not only provide occupational health and safety information and services but also collect information from workers about their health and safety needs and experiences.

As already established, several authors and researchers have expressed their concerns about the limitations of the WHO health definition as it to an extent indicate that no one individual can consider themselves to be healthy. With the growing working population comprising different demographics, we need a more encompassing definition of health to accommodate a greater percentage of the working population. The WHO definition can be considered the first step towards a more profound understanding of the concept of health as our understanding of physical conditions, mental functioning and social well-being as it concerns different disciplines has remarkably evolved over the years.

Another definition of health known as the Meikirch Model states that: "Health is a dynamic state of well-being characterized by a physical, mental and social potential, which satisfies the demands of a life commensurate with age, culture, and personal responsibility. If the potential is insufficient to satisfy these demands the state is disease."

Bircher and Hahn (2017) explains this definition in-depth breaking the term 'potential' into two components; a biologically given and a personally acquired potential. The biologically given potential is the gift of nature that an individual is given birth to with and it has a finite value as it tends to decrease as the individual ages till the time of death when it equals zero while the personally acquired potential starts quite small at the time of birth and rapidly increases during childhood and adolescence with a tendency to continue rising as the individual nurtures it or might be damaged by neglect or other social vices. It may also be negatively affected by social surroundings that are not supportive enough, over-demanding or plain destructive. These social determinants interact with and influence the potential of the individual to respond satisfactorily to the changing physiological, psychosocial, and environmental state and thereby modifies their working conditions. This emphasizes the importance that social support gives in the area of health (Bircher and Hahn, 2017).

For this research study, we need a concept of health that respects the dignity of each person, distinguishes between health and disease, and clarifies the relationship between workers and their employers as we seek to focus on the health of workers in the flexible working environment. We shall be adopting Huber *et al.* (2011) definition: 'The ability to adapt and to self-manage, in the face of social, physical and emotional challenges' as it focuses more on the capacity of individuals and the opportunities that are available to them rather than focusing on their disabilities.

3.1.2 Well-being

"Well-being" according to Oxford dictionary is defined as "the state of being comfortable, healthy, or happy. "(English by Oxford Dictionaries)**.**

Well-being as a keyword in the WHO definition of health focuses on mental health as "a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community." This definition is largely dependent on the choices made as a result of better knowledge of the working environment and can further improve the quality of the physical, mental and social state of workers. ('WHO | Mental health: a state of well-being', 2014).

A research by Dodge *et al.* (2012) aimed at solving the challenges of defining well-being proposed a new definition of well-being as *"*the balance point between an individual's resource pool and the challenges faced; using a see-saw to represent the drive of an individual to return to the set-point for well-being as well as the individual's need for equilibrium. In essence, stable well-being is when individuals have the psychological, social and physical resources they need to meet a particular psychological, social and/or physical challenge. When individuals have more challenges than resources, the see-saw dips, along with their well-being, and vice-versa.*"* This definition seeks to make well-being tangible and operationalized.

Kim (2012) elaborates on the evolution of well-being at work taking it from the labour approach (Occupational health) and projecting it onto the public health approach (Workers' health). This approach showed the actions, health-issues, labour contracts, etc. as well as those the actors, health determinants and stakeholders involved in maintaining a state of well-being at the workplace (Kim, 2012). Workers being half of the whole population and spending a considerable amount of their lifetime working give credence as to why attention should be given to this area of study to keep up with the NWW ensuring that their exposure to the unhealthy working environment is kept to the barest minimum.

The Center for Disease Control and Prevention, as cited in Kahneman and Deaton (2010) seems to provide us with a clear and most suitable description of well-being for this research which states that: "There is no consensus around a single definition of well-being, but there is general agreement that at minimum, well-being includes the presence of positive emotions and moods (e.g., contentment, happiness), the absence of negative emotions (e.g., depression, anxiety), and satisfaction with life, fulfilment and positive functioning"

This definition encompasses the various components researchers have identified that contribute to the overall health and well-being of an individual and is best suited for this research (Kahneman and Deaton, 2010). We will be focusing on the mental health which consists the emotional, psychological and social well-being as well as how the physical environment affects the health of workers.

3.1.3 Workplace Users

The definition of 'work' by the Cambridge dictionary as "an activity, such as a job, that a person uses physical or mental effort to do, usually for money" (Cambridge English Dictionary), as well as the definition of workplace by same as "a place where people do their jobs" (Cambridge English Dictionary), coupled with the changing world of work as seen in the concept of NWWS in chapter 2, it is imperative for this research to define who 'workplace users' are.

The term 'users' as related to the workplace has been researched on by some authors as will be shown below. However, it's meaning still remains ambiguous since the workplace users comprise people of different disciplines as well as clients and customers being offered services.

Lindholm and Nenonen (2006) describe building users as all people with an interest in a building, including workers, administrators, customers or clients, guests, owners, design and maintenance teams, and particularly special interest groups such as the disabled people.

Land and Hirschheim (1983) recognizes the existence of various types of users: senior management who are ultimately responsible for the well-being of the organization and who can use inputs from information system; middle management who are responsible for the administrative personnel using the information system; and finally those workers who communicate with the system on a regular basis (Land and Hirschheim (1983), as cited in Terry and Standing, 2003).

Vischer (2008a) points out that it is important to decide on who the users are. Users were classified as those that may be carrying out activities inside the built environment, and they might also be users of spaces created outside the enclosing architectural elements (gardens, streets, stairs, hospital rooms, office buildings, etc.). This statement, however, contends with Land and Hirschheim (1983)'s definition as it emphasises on the likelihood of more than one homogeneous user groups with conflicting interests. (Vischer, 2008a)

A user is defined in the Business dictionary as an "entity that has authority to use an application, equipment, facility, process, or system, or one who consumes or employs a good or service to obtain a benefit or to solve a problem, and who may or may not be the actual purchaser of the item" (BusinessDictionary.com).

According to Tucker and Smith (2008), the user is "the customer or client in an organizational sense receiving facilities management (FM) services within a workplace environment" (Tucker and Smith, 2008).

In defining users of the NWW, time is a factor as users may change over time. In other words, companies have to seek out the most flexible office layout to accommodate the ever-present moves and changes characterised with NWW (Vischer, 2008a).

3.2 THE ROLE OF REGULATORY BODIES IN PROTECTING HEALTH AND WELL-BEING

According to the European Framework Directive, employers have a legal obligation to ensure the health and safety of workers in every aspect related to work which includes psychosocial risks in the workplace. The implementation of these provisions may vary from one country to the other but the framework specifies that these risks must be identified, assessed, prevented and managed (European Commission, 1989).

Therefore, there exists a need for assessing the effects of these psychosocial factors. Over the years, assessments involving periodic monitoring of psychosocial factors at work and different ways of measuring their effect, have been carried out by researchers (Kalimo, El-Batawi and Cooper, 1987; Testad *et al.*, 2010; Sohn, Choi and Jung, 2016). However, with the evolving organizational changes in the workplace, it is pertinent to evaluate routinely the psychosocial work environment because of their detrimental effect on employee mental health and productivity.

One of the most important aspects to consider is that risk assessment at work requires the use of valid and reliable methods in order to identify the risk factors in organizations (European Commission, 1996; Leka and Cox, 2008).

The most important standard of OHS management is OHSAS 18,001 which addresses all OHS risks, but it does not explicitly mention the psychosocial work environment as it only defines ill health as "an identifiable, adverse physical or mental condition arising from and/or made worse by a work activity and/work-related situation". This has recently been supplemented with a British publicly available guideline (PAS 1010) focusing specifically on psychosocial risk management while still following the OHSAS 18,001 understanding of how to manage the work environment (Hohnen, Hasle and Jespersen, 2014).

The WHO Healthy Workplace Framework reports that The Health & Safety Executive (HSE) in the UK has developed and implemented Management Standards that deal with a number of issues related to the organization of work. Standards are intended to provide guidance to employers. Although the Standards in themselves have no legal force, HSE specifies a minimum percentage of the workforce

that confirms the existence of a certain state of organizational affairs, a threshold within each standard. Citing the threshold for demands of the job that specifies that at least 85% of employees should agree that they are able to deal with the demands of their job as described in the criteria. HSE provides indicator tools used to measure these percentages and employers are legally required to assess risks to mental health using these tools. However, there is no legal guidance on what employers are to do with the results. The results are rather used to train employers on how to improve the situation in areas found to be weak. These activities are believed to be helpful in proving due diligence for the employer in the case of litigation by an employee, and in fact by encouraging worker-employer consultation, typically leading to improvements in the organizational culture and climate (Fingerhut *et al.*, 2010).

3.3 HEALTHY WORKPLACE

3.3.1 Background

Over the years, the idea of a healthy workplace has evolved, originating from a variety of disciplines (e.g. medicine, occupational health and safety) and integrating other related, but different, literature (e.g. epidemiology, psychology). Healthy workplace definitions in the past had focused primarily on the physical safety of employees with specific emphasis on the physical environment and employees' physical safety at work. Lately, these definitions have been broadly expanded to include psychosocial dimensions of occupational well-being (Hurrell, Kelloway and Brown, 2014).

The Center for Disease Control and Prevention has a Workplace Health Model which reports that employers are responsible for providing a safe and hazard-free workplace, as well as numerous opportunities to promote individual health and a healthy work environment. It encourages organizations to create an employee-centred wellness culture that translates into providing supporting environments where safety is guaranteed and health can emerge, as well as providing their employers with access and opportunities to engage in a variety of workplace health programs (*CDC*, 2016).

Wilson *et al.*, (2004) described a healthy organization as one characterized by deliberate, systematic and collaborative efforts to optimize the well-being and productivity of employees by providing well-designed and meaningful jobs, a positive social-organizational atmosphere, and open and equitable career and work-life development opportunities.

According to Grawitch *et al.*, (2009), to create a healthy workplace, employees must be actively involved in shaping organizational practices. They note that the families and work institute claim that the key to a healthy workforce which in turn reflects on the workplace, depends on the implementation of effective work-life balance interventions.

The WHO proposed a definition of a healthy workplace as:

"A healthy workplace is one in which workers and managers collaborate to use a continual improvement process to protect and promote the health, safety and well-being of all workers and the sustainability of the workplace by considering the following, based on identified needs:

- Health and safety concerns in the physical work environment;
- Health, safety and well-being concerns in the psychosocial work environment including organization of work and workplace culture;
- Personal health resources in the workplace;
- Ways of participating in the community to improve the health of workers, their families and other members of the community" (Fingerhut *et al.*, 2010).

The WHO definition is widely accepted as it's specifically intended to address the prevention of accidents or illnesses. The WHO developed a healthy workplace framework which takes on a broader view and explores healthy workplaces from an occupational health point of view in the context of the healthy workplace model of WHO, comprising of physical work environment, psychosocial work environment, personal health resources, and enterprise community development (Fingerhut *et al.*, 2010).

In recent times, the work environment is increasingly being observed as a set of mutually dependent factors that make up a complex whole which acts on people at work. With the NWW being adopted in developing and industrialised countries, psychosocial factors have gained a lot of attention in the research area as the EU member countries gave it "top priority" among work environment factors (Rial-Gonzalez *et al.*, 2005). This makes it an important aspect to consider when analysing the effects of the work environment on the health and well-being of its workers. Work environments can be a major source of adverse psychosocial factors resulting in stressful experiences which may vary widely in individuals, work setting, the type of job and how it is being carried out (Hislop and Axtell, 2009).

3.3.2 Psychosocial risk at work

Psychosocial risks arise from poor work design, organisation and management, as well as a poor social context of work. A growing body of research shows that negative work environment can result in negative psychological, physical and social outcomes such as work-related stress, burnout or depression, cardiovascular diseases as well as the economic impact that the poor mental health of its employees has on organizations (Johnson and Hall, 1988; Mahan *et al.*, 2010; Cheng *et al.*, 2012) . According to Komisjon (2017), over half of EU workers report that stress is common in their workplace and 4 in 10 think that it is not handled well.

Workplace stress has a serious impact on the productivity of workers in various ways such as;

- Absenteeism as It accounts for around half of lost working days as the absences are relatively longer than those arising from other causes (Slany *et al.*, 2014);
- Presenteeism as stress causes reduced performance at work and can lead to five times more accidents (Kivimäki *et al.*, 2005);
- About a fifth of staff turnover is related to stress at work as it may contribute to an increased rate of early retirement (Heponiemi *et al.*, 2008).

3.3.3 Psychosocial work factors

To define psychosocial workplace factors, a good starting point might be the Oxford English Dictionary's first definition of 'psychosocial' as "of or relating to the interrelation of social factors and individual thought and behaviour" (Oxford English Dictionary). This definition implies that social interactions have effects on individual's health and relating this to the workplace, it raises concern on these factors and how they might influence workers' health through their effects on individual characteristics.

As a result of the accelerating technological changes in the workplace, workplaces that promote mental health and provide support to people with mental disorders are more likely to increase productivity, retain their workers and reduce absenteeism, thus benefiting from the associated economic gains. Organizations and government policymakers are realizing that the social and economic costs of mental health problems in the workplace cannot be ignored.

The Joint ILO/WHO report on psychosocial factors at work considered that the psychosocial climate of a group depended not only on its structure and living conditions but on an entire range of sociological, demographic, economic and social problems (The Joint ILO/WHO Committee on Occupational Health, 1984).

Kalimo, El-Batawi and Cooper (1987) explains workplace psychosocial factors as the factors necessary for the planning and organisation of workers' capacities, needs and experiences concurrently in order to produce interactive results.

According to Guarding minds at work 'Psychosocial Factors' (2018), psychosocial factors are "elements that impact employees' psychological responses to work and work conditions, potentially causing psychological health problems." These factors include the mode in which the work is performed (i.e., the workload, the work methods and the set deadlines) and the working conditions (i.e., the relationships and interactions with managers, colleagues and clients)

A broad definition to psychosocial factors at work is given as “interactions between and among work environment, job content, organisational conditions and workers' capacities, needs, culture, personal extra-job considerations that may, through perceptions and experience, influence health, work performance and job satisfaction” (The Joint ILO/WHO Committee on Occupational Health, 1984).

With the aim of fostering a mentally healthy workplace, Guarding minds at work outlined 13 psychosocial factors for health and safety in the workplace. Table 5 gives a detailed representation of these factors explaining how the employee and employers can benefit from them respectively. For each of the factors, lower scores indicate greater risk to employee psychological health and organizational psychological safety; higher scores indicate greater employee and organizational resilience and sustainability. The factors are interrelated and therefore influence one another; positive or negative changes in one factor are likely to change other factors in a similar manner (*Mental Health - Psychosocial Risk Factors in the Workplace : OSH Answers*, 2017). In table 5 below, the factors are listed addressing the peculiar benefits both the employer and employees derive from them.

Table 5: Psychosocial Factors at work (source: Author)

Psychosocial work factors	**Definition**	**Possible benefits**	
		Employee side	**Employer side**
Psychological Support	A work environment where co-workers and supervisors are supportive of employees’ psychological and mental health concerns and respond appropriately as needed.	Workers experience greater job attachment, job commitment, job satisfaction, job involvement, and work mood.	High job retention and increase in work performance.
Organizational Culture	A work environment characterized by trust, honesty and fairness.	Trust is a predictor of cooperative behaviour, organizational citizenship behaviours, organizational commitment and employee loyalty.	This attracts new workers and retains existing workers.
Clear leadership & Expectations	A work environment where there are effective leadership and support that helps employees know what they need to do, how their work contributes to the organization, and whether there are impending changes.	Increases workers morale, resilience and trust, and decreases employee frustration and conflict.	Effective management of activities.
Civility & Respect	A work environment where employees are respectful and considerate in their interactions with one another, as well as with customers, clients and the public.	Greater job satisfaction, greater perceptions of fairness, a more positive attitude, improved morale, better teamwork, greater interest in personal development, engagement in problem resolution	Enhanced supervisor-staff relationships, and reduction in sick leave and turnover.

Psychosocial work factors	Definition	Possible benefits	
Psychological Competence & Requirements	A work environment where there is a good fit between employees' interpersonal and emotional competencies and the requirements of the position they hold.	This is associated with fewer somatic health complaints, lower levels of depression, greater self-esteem, and a more positive self-concept.	This increases productivity as there will be fewer cases of presenteeism.
Growth & Development	A work environment where employees receive encouragement and support in the development of their interpersonal, emotional and job skills.	This increases goal commitment, and job satisfaction. Such workplaces provide opportunities for employees to build their competencies, which will help their current jobs and also prepare them for possible future positions.	With workers' improvement, employers will benefit in optimum delivery of services and tasks will be completed in a shorter time.
Recognition & Reward	A work environment where there are appropriate acknowledgement and appreciation of employees' efforts in a fair and timely manner.	Motivates employees, fuels their desire to excel, build their self-esteem, encourages employees to exceed expectations, and enhances team success.	This lowers employee turnover and increases productivity. It also builds the reputation of the organization.
Involvement & Influence	A work environment where employees are included in discussions about how their work is done and how important decisions are made.	When employees feel they have meaningful input into their work they are more likely to be engaged, to have higher morale, and to take pride in their organization.	This opens a line of communication for the exchange of new ideas between employer and employees.
Workload Management	A work environment where tasks and responsibilities can be accomplished successfully within the time available.	There is a unique relationship between job demands, intellectual demands and job satisfaction. Even where there are high demands, if employees also have high decision-making ability, they will be able to thrive.	Early completion of job tasks.
Engagement	A work environment where employees feel connected to their work and are motivated to do their job well.	This results in higher productivity, morale and motivation. It also enhances task performance.	Higher profitability for the organization and greater customer satisfaction.
Balance	A work environment where there is recognition of the need for balance between the demands of work, family and personal life.	A healthy work-life balance makes employees feel valued and happier both at work and at home.	This reduces stress and the possibility that home issues will spill over into work.
Psychological Protection	A work environment where employees' psychological safety is ensured.	Workers demonstrate greater job satisfaction, enhances team learning behaviour and improved performance.	Increased productivity and attracts younger employees.
Protection of Physical Safety	A work environment where management takes appropriate action to protect the physical safety of employees.	Workers will feel more secure and engaged at work. They have higher levels of confidence in safety protection at work also experience lower rates of psychological distress and mental health problems.	Reduction of absenteeism in the workplace.

3.3.4 Psychologically healthy workplace

With the evaluation of psychosocial factors at work, psychosocial risks and work-related stress are among the most challenging and growing workplace health and well-being concerns as they cause a decline in workers' physical and mental health resulting in negative consequences for the organization.

Psychological health in the workplace have been a topic of discussion by a lot of authors over the years giving knowledge to the fact that work in any form has a significant effect on the emotional and psychological well-being of workers, either for better or for worse (Pierce, O'driscoll and Coghlan, 2004; Vischer, 2008b). With this rising concern, particular attention should be given to the quality and psychological health of the workplace environment.

A psychologically healthy and safe workplace has been defined in the National Standard of Canada on Psychological Health and Safety in the Workplace as "a workplace that promotes workers' psychological well-being and actively works to prevent harm to worker psychological health due to negligent, reckless or intentional ways" (Shain, Arnold and GermAnn, 2012).

Hurrell, Kelloway and Brown,(2014) also defined a psychologically healthy workplace as not only workplace that aim to reduce negative demands and stressors but also promote organizational resources to improve well-being.

3.3.5 Work-life balance

The physical, emotional, psychological and social experiences an individual encounter in the workplace affects the health and well-being of such individual. With the increasing demand for flexible working conditions, these experiences can easily spill over into non-work domains. Workers spend about a quarter to a third of their waking hours at work and don't necessarily stop working when they leave the traditional workplace, thanks to the advent of ICT (Conrad, 1988; Harter, Schmidt and Keyes, 2004). In addition, job satisfaction is estimated to account for a fifth to a quarter of life satisfaction in adults (Harter et al., 2003). Taking these growing figures into consideration, organizations should be kept abreast on the ways it can develop, implement and monitor the health and well-being of its workers. This intersection between work and non-work domains has become a popular research area, recognizing that a person's work-life and private life are not separate entities but, instead, interrelated having reciprocal effects on each other (Zedeck and Mosier, 1990).

A healthy workplace, as defined by Sauter, Lim and Murphy (1996), explains the healthy workplace not just as a physical location but rather as an organization that "maximizes the integration of worker goals for well-being and company objectives for profitability and productivity". The primary focus of many organizations was to avoid being unhealthy as opposed to optimizing health but since the

Occupational Safety and Health Act of 1970 mandated development and enforcement of worksite standards and assigned employers the responsibility to maintain safe and healthy work environments, measures to ensure *health protection* have been important in the prevention of work-related injuries and illnesses (Silverstein, 2008). This definition constitutes two main elements which are the performance of the organization and the health of the employees (Jaffe, 1995). This definition suggests that when an organization seeks to become a healthy workplace, the organization together with the workers within it must be considered. Browne (2000) argument further exemplifies the need for dual consideration of the worker as well as the organization as it explains that human resource practices "are only progressive if the concern for organizational level outcomes is matched by a concern for the well-being of employees who are directly affected by these practices". Given the multiple forces that drive organizations to focus on organizational health, it is vital to identify the types of practices that are employed by healthy workplaces and how these various programs and policies contribute to better employee and organizational health.

A more comprehensive definition of a healthy workplace can be found in (Adkins, Quick and MOE 2000), describing the four guiding principles of organizational health. The first principle suggests that "health exists on a continuum from mortality to vibrant well-being." The purpose of organizational health is not merely to avoid ultimate destruction, but rather it is a quest to move toward abundant life. Organizations should focus on promoting positive health outcomes instead of acting only to prevent the negative outcomes of poor health. The second principle states that "organizational health is a continuous process, not an obtainable state." This reiterates that the organization plays an important role in maintaining good health for its workers, even if and when optimal health is achieved. As a healthy state is not a one-off achievement, constant attention, evaluation, and action are needed in seeking new and improved ways to maintain a healthy workplace. The third principle addresses the systemic nature of health, arguing that "organizational health is the result of inter-connections between multiple factors." An organization can only be healthy if all of its parts are free from disease. The organization must engage in risk assessment, based on its perceived threats and vulnerabilities. Moreover, damaging factors within the organization must be minimized in order to reach optimal systemic health. The final guiding principle of organizational health is its reliance on fulfilling relationships. Action within an organization is achieved through constant communication, collaboration, and relationship building.

Evidence shows that healthy workplaces improve the recruitment and retention (Secker, 2003), workers' well-being, and quality of life (Kowitlawkul *et al.*, 2019), and organizational performance (Tran *et al.*, 2018).

3.4 ELEMENTS THAT AFFECT HEALTH IN THE WORKPLACE

Interior design is described as, “the art and science of understanding people's behaviour to create functional spaces within a building through creative and technical solutions” (El-Zeiny, 2012). Its effects are aesthetically pleasing and perform the required function of appealing to the senses of the occupants in a building. It goes on to enhance the quality of life and is a major contributory factor in job satisfaction. A satisfied worker is most at times a healthy worker and tends to avoid absenteeism. A collection of satisfied workers in a workplace that instils a very high status of work quality results in a massive turnover for business owners(El-Zeiny, 2012).

Workplace design is still transitioning from the provision of individual offices for employees to shared or open-plan workspaces and subsequently progressing to working at any place. The characteristic design of these areas plays a significant role in the health and well-being of the employees as they spend a major part of their awake hours in there (Brennan, Chugh and Kline, 2002). The factor driving this mode of office design and transitioning stems from the fact that it is economically profitable to all employers to pay less for workspace whiles achieving the maximum level of productivity. This strategy is cheaper to the organisation and makes it possible to accommodate more employees in less area (Davis, Leach and Clegg, 2011). In another purview, the design is becoming relevant as research has shown that a growing number of companies are using the office design as an additional means of attracting and keeping millennial workers. Office design has hence been recognized as one of the major factors affecting an employee’s decision to join, remain or leave an organization (El-Zeiny, 2012).

Nikolaeva and Russo (2016) argue that this approach and rapid transitioning of office design, is deemed as being ideological and as such not based on empirical findings and maybe not only be inimical to the work required but also detrimental to the physical and social well-being of workers. Thus, the need to determine whether the design and use of shared workplaces such as co-working spaces have health implications (Richardson *et al.*, 2017). The occupancy, social density and acoustic as well as visual privacy are all fundamental design considerations in interior design. Architects implement these requirements of occupants through the design choices made when planning for office layout and furnishings. These design considerations affect all occupants in diverse pedigrees and have significant effects on their individual health. So, this section will address the Indoor environmental elements that have associated effects on the health and well-being of the worker.

3.4.1 Impact of Indoor Air Quality on the Health of a Worker

This section addresses Indoor Air Quality (IAQ) and its effect on the health of building occupants. IAQ does not only have short term but also there exist long term impact on the health and well-being of

its occupants (Wargocki *et al.*, 2002). Two very common strategies are used by designers in dealing with IAQ in buildings. The first strategy is to implement a design strategy that improves air quality by elevating the ventilation rate which sequentially reduces the volume of air pollutants. The second method is to reduce the source of pollution within and around the building which in turn reduces the supply of pollutants indoors (Daisey, Angell and Apte, 2003). The rate at which outdoor air is supplied is presumed to be proportional to the content of pollutants in the building. The amount of pollutants present in a building varies based on the number of occupants. Therefore, buildings must be equipped with a mechanism that accurately assesses the amount of pollutants and thus reduces the rate of introducing outdoor air (Bakó-Biró *et al.*, 2004). With sustainability and green building construction at the core of discussions in recent times, the use of low polluting construction materials and the effective management of IAQ can be achieved by adopting appropriate air handling systems (Wargocki *et al.*, 2002). Seppänen and Fisk (2002) conducted research which revealed that occupants of naturally ventilated offices exhibit fewer sick building symptoms as against occupants of air-conditioned offices. That being said, there is no need ignoring the era of megacities where some of the highest levels of outdoor pollution have been recorded. Mechanically ventilated buildings usually come with a filtering mechanism for the outdoor air before they are circulated indoors. This is quite beneficial for densely polluted cities (Bluyssen, 2004).

To investigate the total indoor air quality, one must monitor the biological, chemical and physical pollutants that affect the occupants (Bluyssen, 2004). To suggest a few methods in measuring indoor air quality, these methodologies can serve the purpose. Experiments that study the biomarkers. Another alternative could be to study a sample of individuals whiles keeping environmental inventories and laboratory studies on the indoor and outdoor atmospheric qualities (Andersen *et al.*, 2009). Aside from the recording of biomarkers, occupant satisfaction levels can be assessed through the use of questionnaires for a rather subjective response on the impact the quality of air has on their health and well-being.

3.4.2 Impact of Thermal Control on the Health of a Worker

Thermal comfort is another segment of the IEQ may be the most important and easily identified parameter of IEQ. For occupants to be extremely productive, they need their workstation to be thermally comfortable. However, thermal comfort is keenly reliant on the level of adaptation of the individual occupant and is associated to factors such as geographical location, climate, time of year, gender, and age (Quang *et al.*, 2014). As warm-blooded as we are, the body tries to maintain a constant temperature of around 37 °C. This is made possible through heat exchange between the human body and its immediate environment. The physiological processes involved are convection, radiation, and evaporation (Dhaka *et al.*, 2013). Thermal comfort has an absolute effect on the energy

consumption of a building for the slightest discomfort causes occupants to readjust the controls. Thermal comfort rests on six pertinent factors; two of which are identified as personal whiles the remaining four are classified as environmental factors. These parameters include air temperature, mean radiant temperature, relative humidity, and velocity for the environmental whiles the personal factors include human metabolic rates and insulation from clothing (Katafygiotou and Serghides, 2015). Nevertheless, these factors must be considered at the initial design phase of building construction as alterations are quite expensive (Nikolopoulou and Steemers, 2003). Gender, age, and climatic conditions do have impacts on the magnitude of thermal comfort perceived by an occupant (Quang *et al.*, 2014). Location, building insulation, outdoor climate and time of year exert a significant influence on the level of perceived thermal comfort (Katafygiotou and Serghides, 2015).

According to the Standard, ASHRAE 55 (2010), thermal comfort is defined as ‘‘the state of mind that expresses satisfaction with the thermal environment in which it is located”. In the tropics, buildings are naturally ventilated thus requiring significantly less energy. This gives occupants a closer to nature feel which keeps one afresh all the time. Thermal comfort is can be well-maintained by adopting less energy-consuming measures such as local air conditioning and task ambient conditioning (Zhang *et al.*, 2010). Perceived comfort differs on an individual basis and is also influenced by the culture. The ultimate thermal adaptation by a worker in an indoor environment and his or her perception of comfort is defined by three factors. They are: physiological adaptation, behavioural adjustment and psychological acclimatisation (Nikolopoulou and Steemers, 2003).

Past researches attempted to define the principle for measuring of temperature variation indoors. There have been established methods essential for measuring thermal comfort. Metrics such as Predicted Percentage of Dissatisfied (PPD) people and Predicated Mean Vote (PMV) are quite common and widely used by designers globally (Al horr *et al.*, 2016)

The PMV model is the recommended measurement method for use in buildings with HVAC systems that manages cold and warm temperatures in both summer and winter respectively. However, this methodology could be applied in non-air-conditioned buildings present in the tropics using an expectancy factor (Ole Fanger and Toftum, 2002). The discomfort generated in a thermally uncomfortable atmosphere does not allow for a healthy and productive environment for occupants in the long term.

3.4.3 Impact of Lighting on the Health of a Worker

Lighting and its associated conditions all serve a singular purpose which is to provide optimum visual comfort. This characteristic feature of the workplace is extremely important to ensure the well-being and productivity of the occupants in buildings (Leech *et al.*, 2002). Several studies have been done on

the effects of this feature on occupants' health and well-being. A few realizations were made, these include a preference for windows and the therapeutic impact of natural views (Aries, 2005).

Visual comfort addresses lighting conditions and the view from occupant's workstation. Insufficient light coupled with daylight or glare lessens one's ability to visibly see objects or details (Leech et al., 2002). Architectural design has a rather profound effect on the overall office lighting which in turn has a direct effect on the well-being of the individual as well as their health in the long run. Access to natural lighting and artificial lighting are essential in ensuring the well-being of occupants in buildings especially in areas where natural lighting is inaccessible in the dark hours of the day (Aries, Veitch and Newsham, 2010). Visual comfort at work does not only affect the individual at work. It is one of the features that greatly affect occupants after the day's work as well. There exist a couple of studies that addressed the impact of visual comfort on sleep quality at home after work. These studies have documented differences in impacts by gender, age, and seasons on the overall discomfort levels and further addressed the long-term health effects (Serghides, Chatzinikola and Katafygiotou, 2015). Quite a number of visual comfort criteria ranging from view type, view quality to social density all have an impact on the physical and psychological health of occupants (Chang and Chen, 2005)

Densely packed offices have a negative effect on visual comfort which usually leads to negative impacts on occupant well-being. McNicholl and Lewis (1994) identifies the Geometry of windows, photometry of surfaces, amount of glazing and a few other features of the interior design as having a substantial impact on the level of illumination to a work area.

Visual comfort plays a pivotal role in the overall comfort, productivity and well-being of the occupants in a building. As such, buildings need to avoid excessive use of artificial lighting whiles maintaining a level of optimality. Hence, designers and facility managers need to understand how to combine the daylight, artificial lighting, glare and visual comfort together so as to create a more holistic appeal to occupants (Aries, Veitch and Newsham, 2010).

3.4.4 Impact of Acoustic Control on the Health of the Worker

Sound as we know it occurs in diverse amplitudes and frequency. Some are quite distractive when they occur especially in a knowledge-based environment. The acoustic comfort of buildings refers to the capacity of the building to shield occupants from noise whiles offering an acoustic environment which is suitable for the intended purpose of the building. A direct relationship exists between acoustic comfort and occupant productivity especially in commercial buildings (Landström *et al.*, 1995). As the implementation of open-plan offices advance, subjects such as acoustic comfort and privacy are common now. They have been identified as significant issues impacting on occupant productivity (Sundstrom *et al.*, 1994). Although they are being recognised as important parameters, study shows

that acoustic comfort is not prioritised like all other design feature this has led to numerous post-occupancy productivity-related issues (Andersen *et al.*, 2009).

Acoustic problems arise from outdoor noise, airborne sounds, sound from office equipment and the sound of nearby facilities (Andersen *et al.*, 2009). For the purpose of this research, acoustic problems in offices are divided into two major categories: annoyance from various noises and the absence of communication privacy. The level, the spectrum, and the variation with time of the noise influence the level of disturbance. A combination of noise such as speech from others, telephone calls, and a couple of irregular sounds do vary and create more annoyance and disturbance compared to the more continuous regular sounds (Veitch, 2011). Similarly, acoustic problems need to be factored into the original design of the building. In addressing acoustic problems at design stages, it is prudent to not just factor what is going to happen indoors but the outdoors as well (Veitch, 2011).

Speech Intelligibility Index is an appropriate way to measure the extent of speech privacy and also to measure the ease of verbal communication within the office building. Noise prevention can be mitigated with three key strategies they are, "(a) absorption of sound using ceiling tile; (b) blocking of sound using workstation panels and workspace layout; and (c) covering up of sound using electronic sound masking techniques" (Loewen and Suedfeld, 1992). However, in implementing all these techniques the workplace designer has to achieve the best balance.

Acoustic comfort is a necessary feature in buildings to avoid long term effects on the occupants. The human body has a high resistance to auditory health implications generated from noise in the office but not to the discomfort created by these distractions. Post occupancy alterations have to be avoided as they usually leave the internal layout totally altered and that is where the acoustic discomforts and distractions usually occur (Shafaghat *et al.*, 2014).

3.4.5 Impact of The Physical Office Setting on The Health of The Worker

The physical workstation mostly identified by their form of office layout such as a shared office space, private office, cubicle or simply a smart workstation desk at any position does present some health risks as well. The design of the furniture used, and computer peripherals used within the smart workplace do present a couple of situational impacts on the health of occupants as well (Meidert *et al.*, 2016). The continuous increase in the number of knowledge-based workers has a paralleled increase in the number of workers who basically spend long hours seated at computer workstations keying in text, scrolling through electronic documents, and searching for information on the web and company cloud services. They repeatedly utilize input devices such as keyboards, touchpads and computer mice usually whiles seated. This repetition of minute specific physical motions may cause an overload of the upper extremities and the back which can cause ailments in the back, shoulders,

arms and hands. Additionally, there is a serious potential for eye strain in this approach to work (Meidert *et al.*, 2016).

Over the years, ergonomists who truly understand the health benefits derived from working in a healthy workplace do so based on the principle of "fitting the work to the worker" and have been exploring the root causes of some job contributory health effects (Punnett *et al.*, 2013). Extended hours of work on the computer basically involves a static posture of the upper body. The head which is usually one-seventh of the overall body weight is kept in position by the functioning of the neck. In the general office setting where a static posture has to be maintained over long hours, the combined effect of the muscles of the neck, shoulder and upper limbs often gets overloaded and suffer injury in the long term (Ming et al., 2004). In addition to the already discussed challenges, frequent problems arise from distortions in posture due to poorly adjusted viewing angles of screens and the imperfect positioning chair and desk. These distortions could shorten the soft tissues, cause muscle tension, weakness, pain and fatigue. Months and years of maintaining this working posture does overload tissues and make occupants prone to ischemic cumulative injuries such as inflammation with swelling, nerve compression and deterioration of tendons and ligaments with provoked pain (Ming, Närhi and Siivola, 2004). To conclude on the impacts of the work setting, eyestrain due to long hours spent working on computer monitors could cause vision problems generally known as Computer Vision Syndrome, with associated symptoms like headaches, dry eye, ocular discomfort, and blurred vision (Meidert *et al.*, 2016). Rosenfield (2011) in his study reported that between 64 to 90% of computer users experience the above warning signs, with a potentially negative effect on productivity and worker health and well-being in general.

There exists a need to implore ways that can assist this era of knowledge-based workers to properly position themselves during their work and in turn reduce the long-term effects of this static mode of sitting by the desk. The advancement in smart working and the provision of informal spaces and hot-desking technologies are all employing ways to make the physical work setting reduce the tendency of being by the desk constantly (Davis, Leach and Clegg, 2011).

Conclusion on the Workplace and Health

This chapter produced a detailed theoretical definition of keywords used in this research as given by several authors. The standards of regulatory bodies already in place for the NWW application was also discussed. It was also clearly established in this chapter that this research is focused on the psychosocial aspect of health which deals with employee perceptions. With this clearly stated, the elements that affect health and well-being in the workplace was discussed. This leads to how these elements can be measured which will be the contents of the following chapter.

CHAPTER 4 - MEASUREMENT OF HEALTH AND WELL-BEING

This chapter represents the various methodologies realised from various works of literature on how to measure health and well-being in the workplace. Assessment of Psychosocial Health available in Section 4.1 begins the chapter followed by a measurement approach that depicts a way to empirically measure health by assessing the workplace type in section 4.2. Next is the measurement approach through the assessment of IEQ factors in section 4.3. Finally, the possibility of organizations implementing a consolidated approach to health measurement is presented after the analysis of the three ways. A structure of this chapter is shown in Figure 5 below.

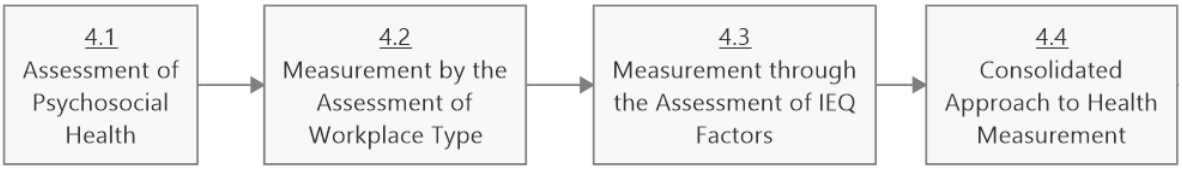

Figure 5: Structure of Chapter 4

Introduction

The office workplace type has got a lot of significance in determining the level of physical activity and stress which has been causally linked to work-related illness (Lindberg *et al.*, 2018). Measuring the impact of the workplace type on the health and well-being of the worker is quite a challenge as the workplace is not independent of the individual's private daily activities. As such, measurement in one way can be focused on the physiological stress response, the perceived stress by the employee and the average level of physical activity undertaken by the worker (Lindberg *et al.*, 2018). In this study, three well-established methodologies which have been successful in measuring the impact of the workplace on the health and well-being of a knowledge worker shall be reviewed.

4.1 ASSESSMENT OF PSYCHOSOCIAL HEALTH OF WORKERS

Background

According to the National Institute for Occupational Safety and Health (NIOSH), occupational stress is one of the most common and costly health problems in the work environment. The institute defines occupational stress as "the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker" ('National Institute for Occupational Safety and Health', 2008). A number of researches on the outcomes of occupational stressors on health have described the 'high stress' or 'high strain' job as one in which

the worker has high job demand and low control (Gómez Ortiz, 1969; Karasek, 1979; Pelfrene *et al.*, 2002).

4.1.1 Job Demand-Control Model (JDC Model)

In studies of occupational stress, a leading theoretical model widely used to find a balance between job demand and job control is the Job Demand-Control model (JDC model). Karasek (1979) developed this two-dimensional model that was based on the interaction between workers and their working environment. The model highlights two important psychosocial job characteristics which can be linked to certain health outcomes: job demands and job control. Job demands refer to 'psychological demands' such as mentally tasking workload, high time pressure on task completion and organizational conflicting demands. On the other hand, Job control referred to the autonomy the worker can exercise in deciding how to fulfil job requirements and perform tasks. Job control labelled as 'decision latitude' comprises of two related psychosocial working conditions; the 'decision's authority' which refers to the worker's degree of flexibility to make decisions on the job and 'skill discretion' which is the extent to which the workers can apply their imaginations and abilities on the job (Karasek, 1979).

Karasek (1979) further states that workers suffer psychological strain not just as a result of the work environment, but also from the combined effects of the demands of a working condition and the lack of decision-making independence (discretion) available to the worker facing those demands

This model is capable of predicting psychological strain and physical ill-health from the interaction of job demands and discretion (or control) such that a combination of the two variables produces interactive effect rather addictive effect. This interactive dimension proposes that redesigning work to increase control would reduce mental strain without the need to reduce workload.

The JDC model is centred on two hypotheses, as shown in figure 6. This figure summarises the type of jobs that might result from a different combination of psychological demands and decision latitude. The first hypothesis (diagonal A) referred to as 'high strain' postulates that psychosocial stress (such as exhaustion, depression and cardiovascular complaints) is induced by the combination of heavy job demands and low control over the worker's tasks and conduct during the working day (quadrant 1). In contrast, 'low strain' can be found in jobs with low job demands and high control (quadrant 3). The second hypothesis (diagonal B) is that work motivation as well as learning and personal development opportunities and active participation in social life have the best possibilities in `active jobs' characterized by high demands and high control (quadrant 2). In a job where neither job demands nor job control is very pronounced, the opposite type of work situation exists (quadrant 4. This 'passive

jobs' work situation is characterised by a decrease in work activities and "negative learning" leading a gradual loss of acquired skills (Karasek, 1998).

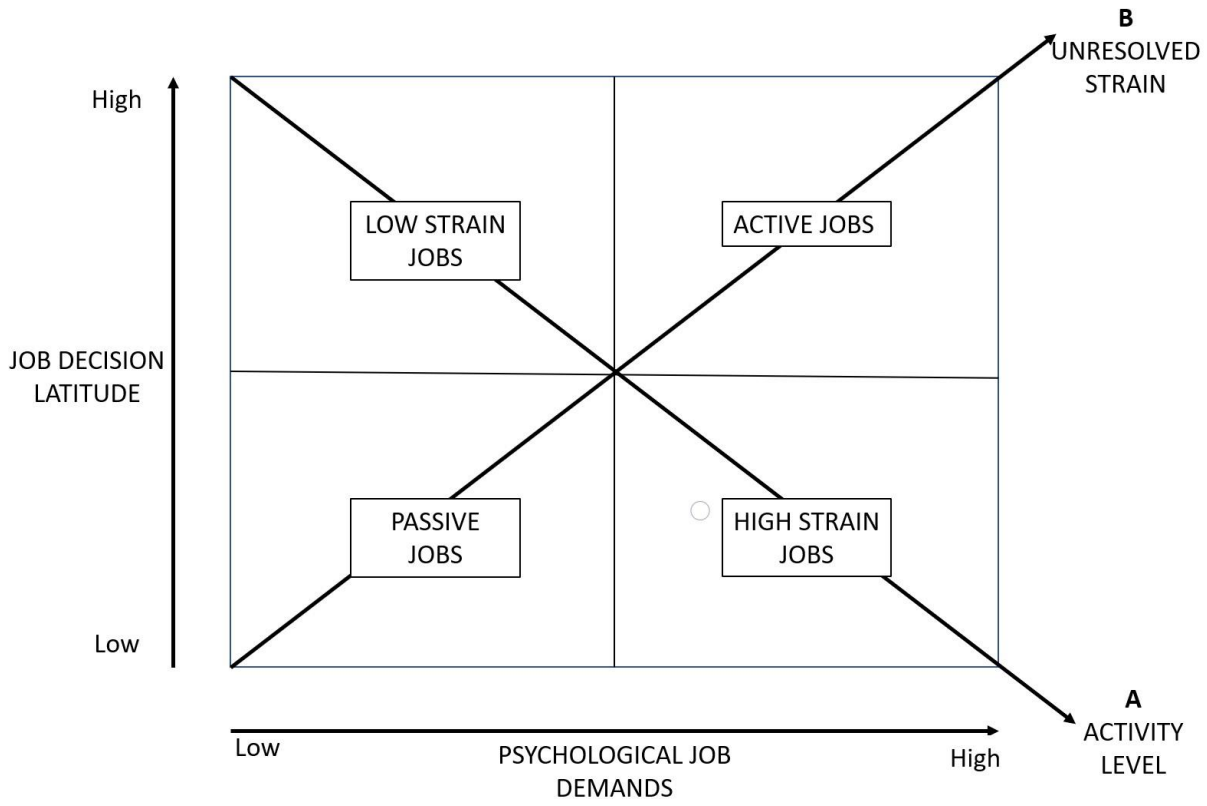

Figure 6: Job Demand model (Karasek, 1979)

The JDC model however only focused on just two job characteristics; job demand and job control, leaving out social interaction in the workplace which is a very important aspect in the psychosocial well-being of workers (Jones *et al.*, 1998). To improve on the model, the author collaborated with other researchers and extended it to include a third dimension, worksite social support. According to the extended `Job Demand-Control-Support' model (JDCS), the highest risk of poor psychological well-being and ill-health is to be expected in the `high-strain' jobs associated with high demands, low control and low social support (Johnson and Hall, 1988). This model over the years has inspired a lot of empirical research and for this purpose, (Karasek, 1985 as cited in Karasek *et al.*, 1998) recommended a standardized and official version of the Job Content Questionnaire (JCQ), a research tool to assess work-related stress that incorporates the scales that belong to the JDCS model.

4.1.2 Job Content Questionnaire (JCQ)

The JCQ is a self-administered questionnaire that has become the most widely used instrument to test the JDCS model for measuring psychological and social characteristics at work (Hurrell, Nelson and Simmons, 1998). As previously stated, the JCQ stemmed from the need for adaptive response to support the emerging empirically-based areas of social behavioural medicine, and psychosocial work assessment which involves a multidisciplinary theoretical model (Karasek, 1998). The instrument has been translated into several languages, and numerous studies have been conducted in order to investigate the predictive effects of these factors on health outcomes across different cultures and populations (Kawakami *et al.*, 1995; Brisson *et al.*, 1998; Cheng, Luh and Guo, 2003; Alexopoulos *et al.*, 2015).

Having designed the JCQ for self-administration, it is often included in other questionnaire resources like a section with a brief introductory sentence on how to answer the questions. However, technical support in the form of a researcher is available for reviewing the instructions. The completion time for the full recommended version is approximately 15 min (Karasek *et al.*, 1998).

In addition to the standard JCQ questions, JCQ users are encouraged to add “company/project-specific questions" relating to the assessment of different working conditions in the worksites being surveyed. While these questions would vary among company/studies, they could be factor analysed with the other JCQ questions and correlated with the standardized JCQ scales used as reference points (*Questionnaires JCQ & JCQ2 - JCQ Center Global ApS*, 2018).

Structure of the JCQ Questionnaire

The JCQ consists of three main scales namely; decision latitude, psychological demands, and social support and several additional scales, such as physical demands and job insecurity. This measures the high-demand/low- control/low-support model of job strain development (Karasek *et al.*, 1998; Alexopoulos *et al.*, 2015). The full recommended version of Karasek’s 1985 JCQ contains 22 items consisting of 3 scales. The psychological demand scale relates to the perception of work or role ambiguity (5 items). The decision latitude scale comprises two subscales: skill discretion (six items) and decision authority (three items). The social support scale is also composed of two subscales: supervisor support and co-worker support (four items each). Thus, three scales (decision latitude, psychological demands and social support) and four subscales (skill discretion, decision authority, supervisor support, and co-worker support) were explored in this research for the development of our model.

Table 6: The JCQ items and their sample questions (Karasek *et al.*, 1998)

Item	Item number	Sample questions
Decision latitude		
Skill discretion	Q1	My job requires me to assimilate new knowledge
	Q2	My work includes some repetitive tasks
	Q3	My job requires me to be creative
	Q4	My work involves a high level of qualification
	Q5	I have the opportunity to develop skills
	Q6	My work includes many activities
Decision authority	Q7	I have much to say about what happens in my work
	Q8	My job allows me to make many decisions
	Q9	I have a lot of freedom to decide how I will do my job
Psychological demand		
Psychological demand	Q10	My job requires me to work very quickly
	Q11	My job requires me to work hard
	Q12	I'm required to do excessive work
	Q13	I don't have enough time to finish my work
	Q14	I'm exposed to conflicting demands from others
Social Support		
Supervisor support	Q15	Immediate supervisor gives me enough support in my work
	Q16	Immediate supervisor takes my ideas into account sufficiently
	Q17	Immediate supervisor has a clear picture of how I work
	Q18	I have a good relationship with my immediate supervisor
Co-worker support	Q19	I am sufficiently informed of what's happening at work
	Q20	The atmosphere in the workplace is good
	Q21	Aggressiveness is rare among my colleagues and me
	Q22	If I want, I can get help from one or more colleagues

The questions are designed to report about and not to evaluate the participant's usual or main job. Thus, the JCQ questions are presented in a language simple enough to be understood by participants at all education levels. The response set is designed to assess the validity of the statement about the work environment on a 4-point Likert scale (ranging from 1 for “strongly disagree” to 4 for “strongly agree”) in order to facilitate similar quantitative weighting of questions (Karasek, 1998; Alexopoulos *et al.*, 2015).

Strength and limitations of JCQ

From the various researches that have been carried out by applying the JCQ, a major strength of the JCQ is its ability to identify, very unambiguously, the key underlying factors that play a role in influencing the psychosocial work environment, with a relatively simple and succinct questionnaire that can be implemented in a wide range of work environments.

However, despite the efforts undertaken by several researchers, JCQ exhibits some weaknesses and opportunities for development as already stated by some scholars.

As a self-report assessment related to behavioural sciences, JCQ might often be faced with common method bias, Chiu *et al.* (2009) suggest that a better way to reduce this is to get information from objective sources and gather measure data from multiple raters.

(Pelfrene *et al.*, 2002) cited that the questionnaire does not fully capture the 'cognitive and psychological workload' which is very crucial in our globalizing economies. They suggested that further research is needed to see whether the JCQ should be complemented by a number of new items that could better evaluate the impact of changing task characteristics as a result of every new technological advance on job stress.

4.1.3 The Copenhagen Psychosocial Questionnaire (COPSOQ)

COPSOQ was developed by the National Institute of Occupational Health (NIOH) in Denmark to meet the need for a standardized and validated assessment tools that covers a broad range of psychosocial factors (Kristensen *et al.*, 2005).

This questionnaire was developed in three versions of different length: a long version for researchers, a medium version for work environment professionals, and a short version for workplaces. This "three-level instrument" was developed with the hope to achieve the following objective:

1. To develop valid and relevant instruments for use at different levels;
2. To improve communication between researchers, work environment professionals, and the workplaces;
3. To make national and international comparisons possible;
4. To improve surveys of the psychosocial work environment;
5. To improve and facilitate evaluations of interventions at the workplaces;
6. To make it easier to for the users to understand difficult concept and theories.

The COPSOQ questionnaire was developed based on the following principles and theoretical considerations:

A. It should be theory-based, but not attached to one specific theory;
B. It should consist of dimensions related to different levels of analysis;
C. It should include dimensions related to work tasks, the organization of work, interpersonal relations at work, cooperation, and leadership;
D. It should cover potential work stressors, as well as resources such as support, feedback, commitment, and good health;

E. It should be comprehensive (i.e., there should not be any significant "white spots" in the picture painted);
F. It should be generic, meaning that it should be applicable in all sectors of the labour market
G. The medium-length and short versions should be "user-friendly" with regard to work environment professionals and respondents (employees) (Kristensen *et al.*, 2005).

Structure of the COPSOQ Questionnaire

As already stated in the objectives, the COPSOQ scales are to cover some of the main components of relevance for research and prevention of psychosocial risks. The first five scales are "demand" scales. These scales are related to the type of production and work-tasks at the workplace. The next five scales are related to the organization of work and job content. Then follow some scales of relevance for interpersonal relations and for leadership. The next two scales are at the person–work interface level. The health and well-being of the employees are elucidated through the following six scales [21–26], and the last four scales measure personality traits (Kristensen *et al.*, 2005).

The COPSOQ scoring system is created by adding the points of the individual questions of the scales and each question carries equal weights. In most cases, there are five answer choices for each question. The weights are: 0, 25, 50, 75, and 100. The value of the scale is measured as the average. All scales, therefore, range from 0 to 100. A respondent who answers to less than half of the questions on a scale is deemed to be absent. If at least half of the questions have been answered by an individual, the scale value is measured as the average of the answered questions (Kristensen *et al.*, 2005).

Table 7: Scheme of the three versions of COPSOQ (Kristensen *et al.*, 2005)

Main scheme for the development of the three versions of the Copenhagen Psychosocial Questionnaire (COPSOQ).		
Context and level	Scales	Sample questions
Type of production and tasks	Quantitative demands	Do you have enough time for your work tasks?
	Cognitive demands	Does your work require that you remember a lot of things?
	Emotional demands	Is your work emotionally demanding?
	Demands for hiding emotions	Does your work require that you hide your feelings?
	Sensory demands	Does your work require that you have very clear and precise eyesight?
Work organization and job contents	Influence at work	Do you have a large degree of influence concerning your work?
	Possibilities for development	Do you have the possibility of learning new things through your work?
	Degree of freedom at work	Can you decide when to take a break?
	Meaning of work	Do you feel that the work you do is important?
	Commitment to the workplace	Do you enjoy telling others about your place of work?

Context and level	Scales	Sample questions
Interpersonal relations and leadership	Predictability	At your place of work, are you informed well in advance about, for example, important decisions, changes, or plans for the future?
	Role-clarity	Do you know exactly how much say you have at work?
	Role-conflicts	Are contradictory demands placed on you at work?
	Quality of leadership	To what extent would you say that your immediate superior is good at work planning?
	Social support	How often do you get help and support from your colleagues?
	Feedback at work	How often does your superior talk with you about how well you carry out your work?
	Social relations	Do you work isolated from your colleagues?
	Sense of community	Is there a good atmosphere between you and your colleagues?
Work-individual Interface	Insecurity at work	Are you worried about becoming unemployed?
	Job satisfaction	Regarding your work in general, how pleased are you with the people you work with?
Health and well-being	General health	In general, would you say your health is excellent, very good, good, fair or poor?
	Mental health	How much of the time during the past 4 weeks have you been a very nervous person?
	Vitality	How much of the time during the past 4 weeks did you feel worn out?
	Behavioural stress	During the past 4 weeks, I have not had the time to relax or enjoy myself.
	Somatic stress	How much of the time during the past 4 weeks have you had a stomach-ache or stomach problems?
	Cognitive stress	How much of the time during the past 4 weeks have you found it difficult to think clearly?
Personality	Sense of coherence	I believe I can cope with most situations in life. What do you usually do when problems arise at work?
	Problem-focused coping	Do you try to find out what you can do to solve the problem?
	Selective coping	Do you try to think of something else or do something you like?
	Resigning coping	Do you accept the situation because there is nothing to do about it anyway?

Strength and limitations of COPSOQ

In the Kristensen *et al.*,(2005) study on COPSOQ, they found out that the objectives for which the questionnaire was developed were met. The questionnaire is theory-based without being attached to a specific model; it covers most of the relevant areas in the psychosocial work environment, and it includes scales at different levels that are appreciative as well as problem-oriented. However, some shortcomings were identified with regard to missing scales, low levels of internal reliability on a few scales, and the wording of a few questions.

(Kristensen *et al.*, 2005) also reported work environment professionals' criticism of the questionnaire. They identified some shortcomings with regards to the use of generic questionnaires in which the same set of questions are used for different work types. It has been pointed out that this doesn't happen in the real world as different things cannot be measured with the same standard. This characteristic also means that the respondents may be forced to answer questions with very little relevance to themselves as they may feel that the issues displayed in the questionnaire are not their problems.

An alternative to the generic questionnaire is the specific job-based questionnaire that is based on the individual workplace and built-in collaboration with the people working there. These questionnaires can be much closer to the workplace's everyday problems, including very general and local issues. However, the problem with the very specific and local questionnaires is that people often ask the researcher: "Is this good or bad? How are we doing compared with other workplaces?" To solve this, we suggest that organizations conduct a WHPP to be discussed in section 3.6 where employers can actively help their staff through interactions to ask appropriate questions specific to their work tasks.

Another shortcoming of the COPSOQ as criticized by users reported by Kristensen *et al.*,(2005) is the choice of the national average as the basis for comparison. The two main arguments have been (i) "Who says that the national average is good? Shouldn't we use a more fundamental criterion such as the risk of ill health?", and (ii) "Why are we being compared with the national average? We would like to be compared with a more relevant comparison group such as our own industry."

With regard to the issue of context, Kristensen *et al.*, (2005) opted to create the medium-length version of the questionnaire in which workplaces will be permitted to add specific and local questions peculiar to them at the end of the questionnaire. There are also no national comparison values for this set of questions and its addition seems to be a very good supplement to the generic part. Regarding the issue of national values, they decided to develop industry-specific normative values for future versions of COPSOQ. These values will enable workplaces to choose between three levels of comparisons: their own workplace, their own industry, or the country.

These and other problems have been addressed in recent versions of the assessment tool (COPSOQ II) (Pejtersen *et al.*, 2010). The most recent version COPSOQ III having 48 scales within 8 domains and covering 148 items have been developed (Llorens, Perez-Franco and Oudyk, 2015).

4.2 MEASUREMENT BY THE ASSESSMENT OF WORKPLACE TYPE

According to Lindberg *et al.* (2018), the economic consequences of work-related stress and mental health problems increased to a tune of $225 billion in the United States and €269 billion in the

European Union. As such, a study was conducted on workers in the United States where 231 workers from 4 different companies were studied to determine the health effect associated with their work type. Their physiological stress response, perceived stress and physical activities were the key variables investigated. Through structural equation modelling, the relationships between these variables and office workstation types were evaluated.

Technological advancements which have led to an increased share of the global workforce being located in the office setting tends to make workers more stationary as against their colleagues in other manual fields. These sedentary workers have a high risk of physical inactivity that leads to work-related stresses. This form of lifestyle makes them susceptible to several health consequences such as fatigue, cardiovascular diseases and a number of chronic diseases which inevitably increases the rates of work exit. Most importantly, "lower physical activity levels at work have been linked to higher levels of perceived stress, major public health risk associated with cardiovascular disease, metabolic syndrome and poor diet." (Lindberg *et al.*, 2018).

The purpose of that study was to assess how the workplace layout and imposed stresses affect the health of the worker and to what extent. In analysing this particular case, the methodology and identified criteria of measurement can be used to assess any workplace to ascertain the extent to which the physiological and psychological health of the employee is affected.

Study Approach

To assess the health effects of the workplace design, work type and seating arrangement on a sedentary worker, Lindberg *et al.*, (2018) gathered these 231 participants and accumulated their data for three consecutive days. Below is a synopsized version of the methods used by these researchers to collate and analyse the health of the participants of this study.

- In monitoring the bodily response to the physical activity of a worker, the selected workers were made to wear a heart and physical activity monitor on the chest and subsequently answered questions every hour during their daily activities. Pregnant women and participants with insulin pumps were exempted from the study.
- The participants were categorized into three categories of workstation and work type. They included, "(1) private office (completely walled enclosure); (2) cubicle (high-walled partitions that one cannot see over while seated; and (3) open bench seating (no partitions or partitions that are readily seen over while seated)" (Lindberg *et al.*, 2018). The further classification was required to identify participants whose main activities were computer-dominant, technical or managerial.

- An online survey was applied to accumulating the demographic information of the participants. On an hourly basis, an ecological momentary assessment of the participants' current mood was recorded on their smartphones using the software application moviesensX. They were made to rank on a Likert scale of 1-7 how they were feeling at the moment they are prompted.
- Capturing the intensity of physical activity by each participant was achieved by recording the overall movement throughout the entire day and the intensity of the movement. A triaxial accelerometer sensor assisted in collecting this data.

A structural equation modelling (SEM) was the preferred choice in estimating both the direct and indirect effects of the office environment on the recorded outcome. This form of analysis was chosen as it seeks to estimate the relationships existing between multiple variables in a single analysis. According to Lindberg *et al.*, (2018) this mode "allows for the exploration of complex relationships between types of office workstations, types of work, individual characteristics, and physical activity and stress outcomes within one comprehensive model." As shown below in figure 7, the solid lines represent the significant paths whiles the subtraction (-) signs indicate a negative relationship between the variables.

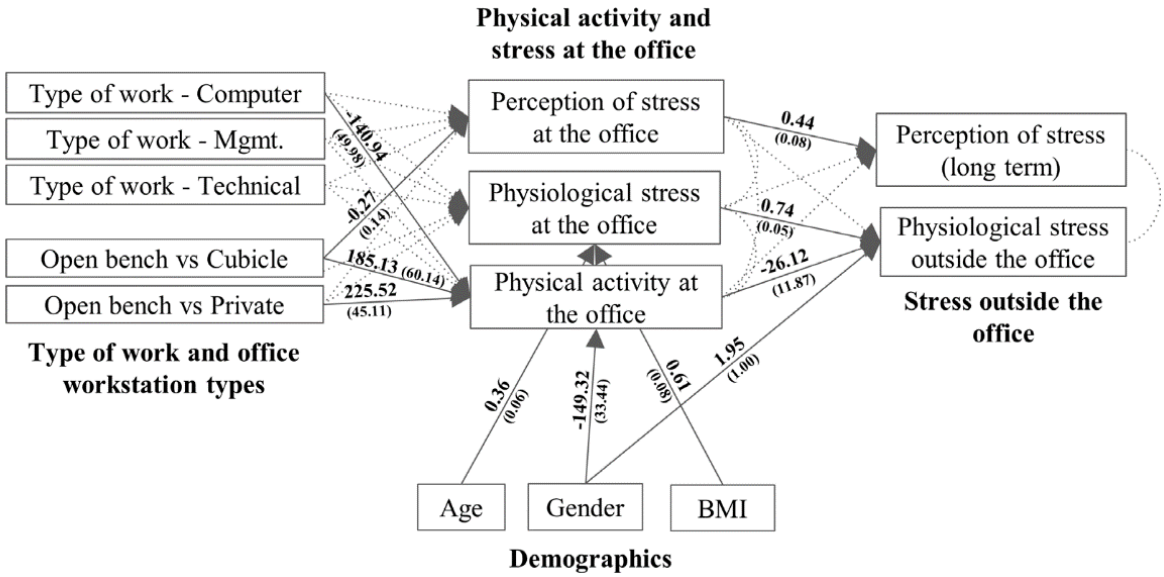

Figure 7: Structural equation model results. (Lindberg et al., 2018)

Study Outcomes

At the end of the study, a total of 231 participants were engaged out of the initial 248 persons who expressed interest in the study. This was a secondary effect of unexpected changes in work scheduling and sickness.

Upon the results identified from the SEM, it was established that workers in private offices had a significantly lower level of physical activity as against the workers in an open bench seating. Also, workers in open bench seating again exhibited a significantly higher level of physical activity than those working in cubicles. The mean difference between these workplace types was finally classified as the workers in open bench seating having a 31.83% higher physical activity against those in private offices whiles having a 20.16% higher physical activity as against workers in cubicles. (Lindberg *et al.*, 2018). It was hence realised that the workers with higher physical activity recorded a significantly lower level of perceived stress as measured by the average 'Tense' EMA ratings.

Ideally, there may be elements of the workplace that individuals carry to their homes after work. As such this research results showed us that workers with a higher level of physical activity had significantly lower physiological stress levels outside the office. There was no active correlation between the physical activity at work and stress levels at home but rather a significant relationship exists between the physiological stress at work and that outside work. In relation to the demographic data distribution, significantly high physiological stress levels existed in the older participants. The female workers exhibited a lower level of physical activity in the workplace but higher physiological stress outside the workplace. This assertion leads one to say that a lot of elements outside the workplace affects females which causes a significantly higher increase in physiological stress as against their male counterparts.

In this mode of measurement, the author was able to significantly establish some pertinent factors that are useful in assessing the health and well-being of a worker in a particular setting. They made the following key identifications in their study:

1. A significant relationship exists between a workstation type and the average physical activity.
2. A clinically meaningful realisation has been made that if the goal is for increased physical activity, an open bench seating should be the recommended arrangement as against private offices and cubicles.
3. Lower physiological stress has been identified to be related to higher levels of physical activity at the office.
4. Older participants, as well as participants with a higher BMI, were found to have higher stress levels.

5. Women exhibit lower levels of physical activities and a corresponding higher level of stress outside the office.

From the above methodology implemented in the measurement of health, an adaptation can be made to assess the health and well-being in diverse settings. This method can further be explored to measure health and well-being in offices that utilize the hot-desking offices, companies that work from co-working spaces and also to companies that implement the working from home policies. It has been established in this study that there exists an unrecognized positive benefit in the seating arrangement that allows for maximum physical activity. As such, there could be other positive benefits in the co-working spaces, hot-desking arrangements and the working from home experience since they are all prone to active movements.

Limitations

According to Lindberg *et al.* (2018), this method is, "observational and as such we cannot confirm a causal relationship between workstation type and physical activity." Further scientific methods can hence be adapted to divulge this *assertion* further. Nevertheless, this research established a significant possibility that shows additional health benefits experienced in the usage of the open bench seating against the dedicated private office setting. This research prioritised the data in four key dimensions. Those prioritised were age, BMI, gender and work type differences. All other possible factors such as ethnicity, educational level, office-specific design, window size and many others were ignored mostly due to lack of data.

4.3 MEASUREMENT THROUGH THE ASSESSMENT OF WORKPLACE IEQ FACTORS.

Improvement of comfort levels and worker satisfaction has been a major concern to researchers now. These improvements increase the productivity of the workers in a rather positive manner. According to research conducted by Elzeyadi (2017), an organization needs to satisfactorily answer these questions about their workplace, "If you build it will they come? How would they feel when they occupy it? And in what ways does a high-performance office environment impact occupant's productivity, health and well- being?" Though all the above are relevant, we focus on the last question here which each facility manager and organization must answer for the response to that question is relevant to the survival of every organization. Now we ask, how are the worker or occupant's health and well-being improving as they go about their daily activities in the office environment? In one way, this can be answered by looking up for key performance indicators that depict a healthy workplace from the office design perspective.

An improvement in health and well-being at the workplace ensures a positive effect on the well-being, energy efficiency of the workplace, productivity and several associated economic benefits. However,

the quest for these characteristics could conflict with each other (Devitofrancesco *et al.*, 2019). As an example, the energy efficiency of a building is positively affected by the reduction in ventilation rates whiles to positively improve the well-being of occupants, ventilation rate requirements are higher so as to positively affect the required indoor air quality. A balance is always required for the characteristic effect of these design effects on the health of the occupant (Elzeyadi, 2017).

Another dimension in the design of the office workspace that affects health is the reduction in the sitting time and sedentary lifestyle of white-collar workers (Dunstan *et al.*, 2013). Measuring the effective sitting time of a workplace is a necessary factor for health promotion in the workplace. In designing a modern healthy workplace this factor is essential in ensuring that employee well-being is assured. An office workplace design architect that arranges the office design approach to cause office workers multiple movements within the day is essential. To quantitatively assess the sitting time of occupants of a building with the acceptable norms, an organization can effectively use the activPAL3 activity monitor which records the data of sitting time, prolonged sitting time, standing time, sit-to-stand transitions and moving time (Dunstan *et al.*, 2013). Recommendations grounded extensively on expert consensus emanating from research work on musculoskeletal reports advise a postural change every 20-30 minutes. A research conducted in Australia on 160 participants demonstrated an acute lowering of glucose and insulin when sitting was interrupted every 20 minutes with a brief stand or walk session as against participants with a straight uninterrupted work session. This metabolic benefit realised here suggests that this process could be a benefit to promoting health in the workplace (Dunstan *et al.*, 2013).

Another dimension used to consider a workplace as valuable to the health of its occupants is to assess the workplace from a sustainability approach. With reference to the LEED and BREEAM certification approach to certifying buildings, one can conclude that a building with a high LEED or BREAM certification or any other sustainability certification is unequivocally a healthy workplace as well (Elzeyadi, 2017).

Over the years, many building assessment procedures have been implemented in assessing buildings allowing the assessment of the complete performance by aggregating of results into a single evaluation and scoring it against a knowing and scientifically accepted values (Esfandiari, Zaid and Azzam Ismail, 2017). The next stages shall depict what to identify and how we shall identify those parameters in a coworking space or a smart working environment.

Design factors necessary to the health of the worker

Early on we discussed in-depth on the impacts of IEQ on the health and well-being of an occupant. Here on we are will be identifying ways to measure health and well-being by assessing the presence

of peculiar design factors and how to use them in the measurement. IEQ is a holistic concept that considers components such as thermal comfort, acoustic comfort, lighting comfort and air quality. Each component can be described with specific performance indicators and benchmarks (Devitofrancesco *et al.*, 2019). By the identification and apportioning of weights to these indicators, a measurement tool will be adapted that provides two distinct outcomes:

1. A global score expressing the overall performance of the building from the IEQ perspective
2. A quantitative evaluation of all indoor environmental comfort components through monitoring and measurement of the variables (Devitofrancesco *et al.*, 2019).

The assessment tool needs to exert a precise focus on users' well-being. There are diverse assessment tools and they all differ according to the adopted category and weighing methods (Elzeyadi, 2017). In our scenario where the focus is on occupants' health and well-being, the focus is going to be on an assessment method that identifies the satisfaction derived by the user, prevents long term ailments and promotes the health of the occupant (Devitofrancesco *et al.*, 2019). Inputs from the international assessment tools from approved bodies for the certification of building such as, the BREEAM, the American LEED, and the international Sustainable Building Tool were considered and their most relevant elements necessary to our scenario identified. To our benefit, each certification system dedicates an area that evaluates conditions of well-being in indoor environments (Devitofrancesco *et al.*, 2019). In their Health and Well-being category, they focused mainly on ventilation and air quality but for the thermal, visual and acoustic comfort, analysis methods were with only one or two criteria. In the next chapter, we will identify all the key performance indicators and what they represent in assessing the health and well-being of the worker.

Using the IEQ tool developed by Devitofrancesco *et al.* (2019) as a guide, a measurement method that identifies key design inputs and its significance in measuring health during the operational phase of a building is proposed. The IEQ tool is a preferred method as it provides a performance assessment based on the measurement of both quantitative and objective data using specific instruments in accordance with laws and technical regulations in force.

A review of Dunstan *et al.* (2013) publication has led us to the need for designing the workplace in a manner that causes knowledge workers to constantly be on the move rather than remaining seated for the full eight hours of work. Public health guidelines recommend on an average day engaging in at least thirty minutes of moderate to vigorous-intensity physical activity (MVPA) to prevent chronic diseases such as type 2 diabetes and cardiovascular disease (Dunstan *et al.*, 2013). In a smart working environment or office setting of a knowledge worker, how will this be achieved as most adults spend much of their time in offices that limit their physical activity and also require them to sit for prolonged

periods of time (Mattke *et al.*, 2103). Although the potential hazards of prolonged sitting in the workplace were first identified in the 17th century no specific inputs propose how to make everyone work whiles avoiding a sedentary lifestyle in the office. Gradually the number of knowledge workers has increased much more than ever and the need to curtail this is imminent (Dunstan *et al.*, 2013).

Summary of Measurement Approaches

Three different measurement options have been described, table 8 below represents the significant characteristics associated with each style and their relevancy to the health and well-being of the worker. Each measurement style addresses a peculiar sector of health only. Thus, to derive a comprehensive approach to an empirical health measurement, distinct sections of each measurement procedure has to be selected and a new approach formulated. In the next section 4.4, a consolidated measurement approach is derived.

Table 8: Characteristics of Health measurement methods

Health Measurement by the assessment of Psychosocial health of workers	Measurement by The Assessment of Workplace Type	Measurement Through the Assessment of Workplace IEQ Factors
1) Comprises of three different questionnaires necessary for assessing the health 2) They are (a) Job Demand Control (JDC) Model (b) Job Content Questionnaire (JCQ) Copenhagen Psychosocial Questionnaire (COPSOQ) 3) JDC was developed by Karasek (1979) whiles attempting to identify the interaction between workers and their environment 4) JDC model is capable of predicting psychological strain and physical ill-health from the interaction of job demands 5) JDC model however only focused on two job characteristics; job demand and job control, ignoring social interaction (a key psychosocial factor) in the workplace 6) The JCQ consists of three main scales namely; decision latitude, psychological demands, and social support. (Addresses what JDC ignored) 7)JCQ Stems from the need for adaptive response to support empirically-based areas of social behavioural medicine, and psychosocial work assessment 8) JCQ is designed for self-administration thus paramount to be used in conjunction with other tools 9) COPSOQ was developed based on 10 specific principles that make it relevant and adaptable for every kind of workplace in the labour market.	1) The purpose was to empirically assess how the workplace layout and imposed stresses affect the health of the worker and to what extent 2) This method actually measures physiological stress response, perceived stress and physical activities at the workplace. 3) Measurement is performed by making workers wear a heart and physical activity monitor on the chest and subsequently answer hourly questions 4) Using structural equation modelling, the relationships between health variables and office workstation types were evaluated 5) Data was prioritised in four key dimensions: age, BMI, gender and work type differences.	1) Each component can be described and assessed with specific performance indicators and benchmarks 2) Benchmarks are derived from organizational goals, CSFs and health standards 3 A quantitative evaluation against benchmarks of all Indoor Environmental Quality components gathered through monitoring and measurement of variables

4.4 CONSOLIDATED APPROACH TO HEALTH MEASUREMENT

An organization employing either of the NWW approaches can apply this methodology. As stated in Lindberg *et al.* (2018), a high level of physical activity could lead to a reduced amount of stress both in and away from the workplace. A lot of methods have been proposed in measuring health and well-being at the workplace. A comprehensive approach in utilizing a selected few shall be applied here in developing a method that can be used by organizations in the measurement of the workplace health.

- **Step 1:** The objective of this section is to accumulate physiological data of the participating employees. This method can be applied to knowledge workers in a coworking space or an office implementing smart technology. As described by Lindberg *et al.* (2018), a chest-worn heart and physical activity monitor should be worn by participants. Data is then recorded for three consecutive days whiles repeatedly answering questions on their smartphones about their individual moods and perceived stress levels. At the same time, the individual movement pattern and continuous sitting hours as indicated in chapter 3.4.3 above and in the Dunstan *et al.* (2013) publication is recorded at this stage.
- **Step 2:** This stage comprises of the assessment of the perceived responses and an expert assessment on the IEQ of the workplace. Three different collections of questionnaires that assess workplace psychosocial health have been reviewed. A proposal of the COPSOQ has been recommended as it was developed by the National Institute of Occupational Health (NIOH) in Denmark to meet the need for a standardized and validated assessment tools that covers a broad range of psychosocial factors (Kristensen *et al.*, 2005). This makes it adaptable to the specific needs of every organization. In reference to the already discussed method of measurement of IEQ proposed by Devitofrancesco *et al.* (2019), the subjective measurement of the workplace can be made in terms of the basic IEQ requirements and design.
- **Step 3:** At this point, all the information required to measure the health and well-being of the worker in a particular work setting has been gathered. One may then move ahead to analyse both the objective and subjective data obtained from the various measurement procedures. Using the LEED, BREEAM, EN 15251-2007, EN 13779 (Indoor Air Quality), ISO 7730 (Indoor Thermal Comfort), EN 12464–1, EN 15193 (Visual Comfort) and {EN ISO 3382–2, EN ISO 3382–3, EN ISO 9921, IEC 60268–16} (Acoustic Quality) as well as other standards specified by the country the measurement is to be done in as a guide, an organization can evaluate the accumulated results to determine the state of the workplace.

Attached below in Figure 8 is a schematic flow diagram summarizing the steps above in the determination of a healthy workplace.

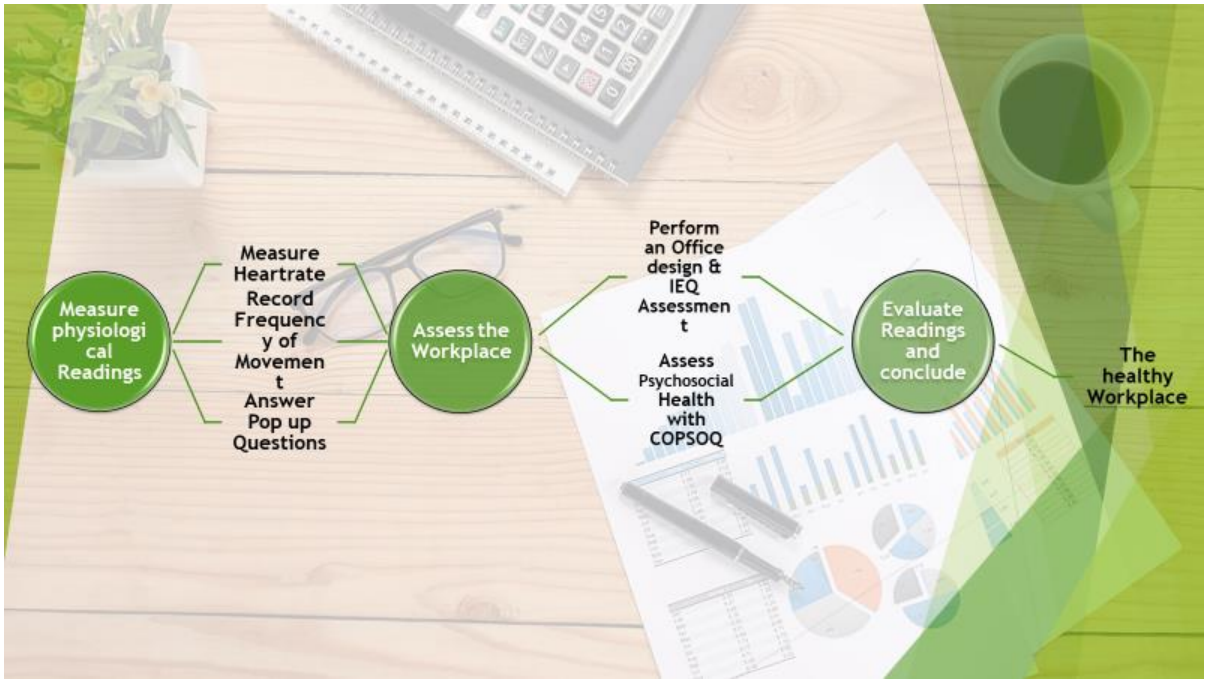

Figure 8: A comprehensive approach for Measuring Health in the Workplace

This approach provides an analysis of the specific impact that a workplace could have on the health and well-being of the worker and can, therefore, be used by an organization for measuring health and well-being. Ideally, not every company can employ the above methodology or afford to get experts to accurately undergo this method of measurement. Therefore, a need for further research on a much simpler approach that can swiftly give an overview of the current state of the workplace. The application of performance management that symbolizes a workplace as healthy was proposed.

Conclusion on Measurement of Health

This chapter was the result of a literature review on the already existing assessment tools used for the measurement of health and well-being. It explained the tools for psychosocial, workplace type and IEQ elements. At the end of this review, a consolidated approach for measuring health and well-being was produced. This approach clearly shows how different tools can be integrated to measure the health and well-being of workers. However, a simpler method needs to be applied. The application of performance measurement that assesses a workplace was proposed. In the next chapter, an assessment of the workplace health and well-being by the use of KPIs will be explained in detail to serve as an alternative approach to the measurement.

Chapter 5 - KEY PERFORMANCE INDICATORS

This chapter sees the development of the performance indicators from a systematic literature review. It begins with the introduction of performance measurement (section 5.1) illustrating its needs and steps to building actionable indicators. After that, the definition of key performance indicators followed (section 5.2), followed by characteristics of key performance indicators (5.3). After these, the selection of key performance indicators was carried out (section 5.4). An overview of the structure of this chapter is shown in figure 9 below.

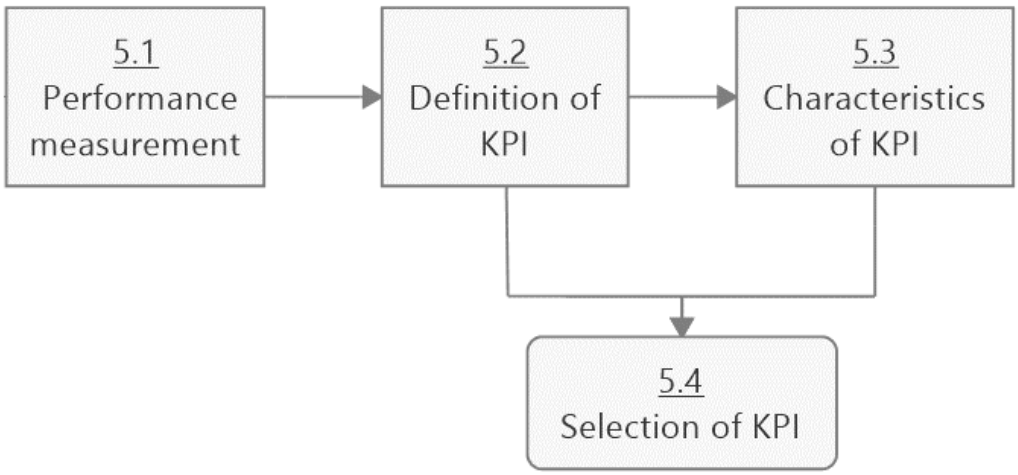

Figure 9: Structure of Chapter 5

5.1 PERFORMANCE MEASUREMENT

The work environment of most organizations is rapidly changing resulting in increased user requirements, increased competition among organizations, value awareness, the emergence of new technology, safety, health and environmental awareness. Therefore, organizations that fail to adapt and react to the challenges of the new environment appear sooner or later to encounter survival issues. As a result of this, managers with the responsibility to measure performance or request that such measures are provided because, without measurement, management can barely exist (Lebas, 1995).

Parker (2000) highlights that performance measurement is something that all organizations do as it's an important aid in making judgements and decisions. They may do it either routinely and extensively, or on an ad hoc basis. By its nature, performance measurement is a diverse subject which is difficult

to define as it is multidimensional. Therefore, when managers speak of performance measurement, it is very crucial to specify how they define it in the context of the work the organization perform (Neely, 2007).

Lebas (1995) explains that performance can mean anything from the output, return on investment, and plenty of other definitions never fully specified. They assert that performance, especially in the case of management, is not so much about past achievements, as generally accepted, but about the future, about the capability of the measure being assessed. Management's purpose is thus about creating and shaping the future of the organization, as well as that of society.

Lebas and Euske (2007) provide a definition of performance as "doing today what will lead to measured value outcomes tomorrow." Performance Measurement is thus concerned with measuring performance relative to some benchmark, be it a competitor's performance or a pre-set target.

5.1.1 Need for Measuring Performance

Artley and Stroh (2001) definition of performance measurement as continuous monitoring and reporting of program achievements, particularly progress against pre-established targets, results in metrics not being objective and not being explicitly specified. They originate from a choice and are performed with a purpose in mind. The purpose of the measure is not sufficient to define what to measure. Rather, it is necessary to operationalize the performance concept before it can be measured.

The reasons for measuring performance vary from organization to organization. Numerous researchers have discussed the advantages of evaluating organizations ' efficiency.

Lebas (1995) gives an overview of five reasons for the need for measurement as well as the type of measures that might help respond to the need.

- Where have we been? The scorecard previously used in the past serves as a guide to investigating how we got to where we are. This reinforces the reward system as rewards are mostly focused on the past, not on the probability of future success and serve to build the archives that will help predict the parameter values used in decision analysis models.
- Where are we now? What is the state of the processes that characterize the organization and what is its potential for future realisation? Simons *et al.* (2000) asserts that performance measurement typically helps organizations in periodically setting goals and then provide managers with feedback on progress towards those goals. The usual timeline for these goals can be about a year or less for short-term goals or for long-term goals span several years.
- Where do we want to go? We want the measures to support the definition of organizations' objectives and targets, and also support the design of action plans. The purpose of

performance measurement is to provide useful information and knowledge that leads to making smart decisions and proper management (Van Aken *et al.*, 2005).

- How are we going to get there? The measures must make provision for budgeting and planning activities, and also support continuous improvement. Kellen (2003) highlights that the organization is a complex organism seeking to survive or thrive in its competitive environment. From this viewpoint, performance measurement serves as a key contributor to the organization's capacity for understanding and coordination. Organizations are not only using indicators to monitor and control specific activities but also to predict the future.
- How will we know we got there? Measures to check whether or not objectives or milestones have been met cannot be isolated from the feedback loop. They are fed back into the reward system and improved upon to repeat the cycle again (Lebas, 1995).

In addition, Lebas (1995) highlights that performance indicators must be created specifically for different users and purposes. The users and purposes are presented in the table 9 below:

Table 9: Users of KPI (Lebas, 1995)

User	Purpose
Manager	For learning and self-improving
Partners	For dynamic action planning and continuous improvements
Supervisors	For the integration of local measures to establish cumulative and eventually corporate-wide measures; tracking of acts assigned to others for continuous improvement and control; feeding the reward system.
Actors in the organization	To create a sense of belonging; to encourage conversations as a foundation for continuous improvement.
External stakeholders	For customers, vendors, financial institutions, and regulatory agencies may demand that certain reports be made available on how well the organization is and will be doing

5.1.2 Steps to Actionable Performance Indicators

Step 1: Establish Goals and Objectives

Organizations exert a special interest in assessing their performance and employee satisfaction in all aspects of work. As such, in building actionable KPIs for an organization, the performance manager must, first of all, establish the goals and objectives of the company (Ho and Chae, 2015). This could be achieved by adopting the following three steps:

1. Identify a problem, situation or objective you are trying to address.

2. Develop a view on how you would like the results to look.
3. Develop a process for how you want things to be done (Badawy *et al.*, 2016).

The main aim of this section is to make known the purpose of the intended KPI. This stage serves as a major referral to users to inform them on what specifically is to be achieved by the KPI.

Step 2: Establish Critical Success Factors (CSF) from the Goals & Objectives

Critical success factors (CSFs) are described as a limited number of key activities that an individual, department or organization should focus on to be successful. They are the specific conditions that measure or facilitate the meeting of organizational goals and objectives within stipulated time frames (Esteves-Souza and Paster-Collado, 2000). An appropriate CSF commences with an action verb and clearly conveys the relevant act that needs to be attended to in a very concise manner. They should utilize appropriate words like attract, perform deploy, manage, etc. A key characteristic of a CSF is the fact that it must contain a measurable activity and a specific time frame (Esteves-Souza and Paster-Collado, 2000).

Step 3: Establish Key Performance Indicators (KPI)

To start with, it is paramount to identify the difference between these two as CSF and KPI. CSFs are elements that are vital for a strategy to be successful whiles KPI's are calculated measures that quantify the CSFs and enable the measurement of that strategic performance. Also, one must note that all KPIs are metrics but not all metrics are KPIs. In most organizations, two kinds of KPIs are adapted. These are the outcome KPIs and the drivers KPI. Outcome KPIs are at times referred to as lagging indicators and they measure the output of the past activity. Alternatively, driver KPIs which are also known as leading indicators or value drivers do measure activities that have a significant impact on outcome KPIs. The driver KPIs measure activity in its current state or a perceived future state. Ideally, an outcome KPI in one dashboard could be a driver KPI in another (Bokor, 2009).

Organizations must endeavour to select best-fit KPIs, share, accept and document them. This ensures the active participation of users and the frequent generation of graphical representation to perform an analysis over time. Company performance managers should have flexible and creative minds when developing KPIs for the ultimate goal is to drive the performance changes required by the corporate strategic plan (Ho and Chae, 2015). A major advantage of KPI to an organization is that they cause users to act differently by improving certain processes and also lead discussion and agenda subjects at the administrative level. Well-designed KPIs provides management with the accessible tools to ask the right questions, instead of giving perfect answers and results (Badawy *et al.*, 2016).

Step 4: Collect Measures

Measures refer to the raw data utilised in conjunction with other parameters to extract the most meaningful information possible (Esteves-Souza and Paster-Collado, 2000). Badawy *et al.* (2016) describes four types of performance measures

1. Result indicators (RIs): its values depict what you have done
2. Key result indicators (KRIs): This particular measure informs you of how you have achieved in a perspective or a critical success factor.
3. Performance indicators (PIs): the results identified here tells you what you must do.
4. Key Performance Indicators (KPIs): The distinction between KPIs and PIs is that KPIs tell you what precisely you must do to highly increase performance whiles PIs tells users what they must just do.

So, in collecting measures, an organization should endeavour to apply the following precautions if the organizational objectives are to be attained:

1. Do not include too many KPIs as it weakens the focus on aims.
2. Avoid a large list of KPIs as they would not have clear connections to the overall organizational objective.
3. To avoid failure of measures, ensure that the performance measures are vividly understood by both the performance management and the users (Badawy *et al.*, 2016).

Step 5: Calculate and Evaluate Metrics from Measures

Metrics are calculations of Measures and are always expressed as ratios, averages, rates, or percentages. We can have an infinite number of Metrics because we can always drill a KPI down into any number of ways to identify a root cause (Ho and Chae, 2015). A performance dashboard captures performance metrics in a layered and visual information delivery system that lets users measure, monitor, and manage the effectiveness of their tactics and their progress toward achieving strategic objectives. A performance dashboard could consist of a couple of dashboards, scorecards, reports, and analytical tools which originates from a common set of data and metrics. On the whole, a performance dashboard is the best graphical representation of a measured and calculated matrix. They enable users to identify challenges and prospects, work together on an approach, act, and adjust plans and goals as needed. A performance dashboard should have a subset of components to be displayed in each level based on the metrics and strategic objectives they support (Eckerson, 2009).

In conclusion, metrics usually refer to the measurements of business activity. But, in a performance management system, the goal is to measure the performances that are in ways aligned with the

business strategy. To specifically distinguish between a metric and a KPI, we must clarify that a KPI embodies a strategic objective and measures performance against any of the multidimensional goals (Eckerson, 2009).

5.2 DEFINITION OF KEY PERFORMANCE INDICATORS

There is a great need for the assessment of workers' health and well-being in the workplace as concerns the NWWs being practised in recent times. Several works of literature have investigated on the positive sides like increased productivity, company turnover etc (Blok *et al.*, 2012a). However, very few pieces of literature have discussed its effects on workers' health and well-being especially the psychosocial aspect. Cox, Issa and Ahrens, (2003) explains that in order to measure performance or effectively assess the impact of any given change, one must first determine the appropriate Key Performance Indicators (KPIs) to focus on to measure its impact.

The focus of this chapter is to develop a set of KPIs that an organization can apply for the assessment of its worker's health and well-being. To achieve these, a literature search was used to generate the initial set of perceived KPIs, after which an analytical network process (ANP) was conducted with the goal of prioritizing the KPI alternatives with respect to selected characteristics.

Parmenter, (2015) defines performance indicators as measures that can be tied to a team or a cluster of teams working closely together for a common purpose. In this case, the team takes responsibility for their performance either good or bad. Therefore, performance indicators are said to give clarity and ownership and should be developed in such a way that management can monitor what teams are delivering and have a profound impact on performance. However, in a bid to achieve more strategic objectives, organizations come up with more important measures which are referred to as 'key performance indicators' (KPIs) by cognoscenti (Bokor-, 2009b).

According to Parmenter, (2015), the difference between performance indicators and KPIs is that the latter is considered fundamental to the organization's well-being which embodies a strategic objective and measures performance against a goal, whereas, performance indicators, although important, are thus not crucial to the organization. Performance indicators complement KPIs by helping teams to align themselves with their organization's strategy. Eckerson, (2009) also agrees that in a performance management system, there is a need to do more than just measurements of activities but also measure the performance aligned with organizational strategy. The targets attached to a KPI are multidimensional, meaning they have software-encoded ranges, a time frame for achieving the goals, and a benchmark against which the goals are measured.

Ahmad and Dhafr, (2002) defines a KPI as a number or value which can be compared against an internal target, or an external target benchmark to give an indication of performance. Iveta, (2012) agrees that It is essential that these values which are obtained from collected or calculated data of any process or activity are assigned to the required strategic value which will have expressing power about the level of organization performance. Targets, as explained by Eckerson (2009), are the goals associated with KPIs and they specify a measurable outcome rather than a theoretical endpoint. Targets can also be set by a KPI team charged with translating strategic objectives into a performance plan.

Iveta, (2012) presents the importance of KPIs uniquely stating that if you don't monitor and benchmark, you won't know how you're performing, what area of your process should more attention be given, and how well your improvements work along the way. Parmenter, (2015) asserts that KPIs tell management how the organization is performing in their critical success factors and, by monitoring them, management is able to increase performance drastically.

Skibniewski and Ghosh, (2009) established that, depending on the time window available, all KPIs should have an effect on an organization's decision in some time scale. Organizations must recognize areas that are the most important to the organization's success. In addition, it is possible to split KPIs into lagging and leading. Eckerson, (2009) explains that lagging indicators measure the output of past activities while leading indicators measure activities that have a significant impact on the outcome. These leading KPIs measure activity in its current state or a future state with the latter being more powerful since it gives individuals and their managers more time to adjust behaviour to influence a desired outcome.

Parmenter, (2015) reports that KPIs focuses on the aspects of organizational performance that are the most critical for the current and future success of the organization. As Chan and Chan, (2004) asserts that KPIs are developed to measure project performance, organizations that want to create alignment and change behaviour need to be monitoring what corrective action have to take place in the future. This makes it very important in workplace change management as KPIs focus on activity in the past week, yesterday, and today, and that planned for the next week and the next two weeks. KPIs are supposed to be measures that link daily activities to the organization's critical success factors (CSFs), thus supporting an alignment of effort within the organization in the intended direction.

According to Shahin and Mahbod, (2007), KPIs reflect and are derived from the organizational goals which management uses to evaluate employee performance and these evaluations typically compare the actual and estimated performance in terms of effectiveness, efficiency, and quality (Cox, Issa and Ahrens, 2003)

KPIs are factors that can be used to measure and monitor these changes in the workplace so as to decide what is to be improved on and how to better manage it. Toor and Ogunlana, (2010) explains this by liking it to success criteria which are the measures by which the success or failure of a project will be judged.

In his paper, Eckerson, (2009) claimed that metrics are a powerful force that can drive organizational change but only if the right metrics are developed and applied. Wrong metrics can damage organizational processes and demoralize employees (Parmenter, 2015).

The selection of appropriate KPIs is very critical as it requires making sure that they are aligned with objectives and strategies when this is achieved, the choice of performance indicators is often apparent. (Iveta, 2012) reports during its creation of strategy map and implementation of the KPIs, that it is necessary to take into consideration the differences of each organization as they should represent the strategy specific to their organizational structure, regardless of which KPIs are used and be regularly reformulated to adapt to the changing working environment.

These different definitions for key performance indicators cited by various researchers all came to the same consensus. So, for the sake of clarity, the characteristics of KPIs should be able to point out what exactly we should look out for during KPIs' selection.

5.3 CHARACTERISTICS OF KEY PERFORMANCE INDICATORS

It is already established from the definitions of performance indicators given by several authors that it is important to regularly track how company goals are progressing in order to be successful among competitors. Setting key performance indicators (KPIs) is one of the easiest ways to do this. The attributes of these performance indicators have an influence on their ability to be efficient and effective in measuring the data for which they were proposed. Understanding these characteristics will enable management to develop the right KPIs for the intended purpose as well as keep all stakeholders involved up to date on how to carry out their duties. A number of characteristics that previous authors already suggest that indicators should satisfy in order to be considered as useful and effective are discussed below

5.3.1 Author 1: Performance Management Strategies

Creating an effective KPI is a fundamental basis to what the KPI is intended to assess. This paper by Eckerson (2009) describes the keen characteristics which when applied would serve as a guide in the identification, selection and proper utilization of KPI's in its correct context. The following identified characteristics would help an organization in delivering high-impact KPIs.

- **Sparse**: Selecting of KPIs is usually compiled by performance management practitioners. In the selection of the specific number to deploy the most logical advice they go by is that less is more. From their experience with clients, they believe that a great number of respondents can only focus on a maximum of five to seven items at the same time; as such deem it prudent to limit the number to that range. A more realistic approach is that usually only a handful of metrics exist and most at times only one can have an impact on the desired outcome. So, concentrating on just a few KPIs helps users to have an in-depth understanding of what the KPIs are precisely driving at and leads them to a satisfactory result. Another reason why indicators are required to be sparse is the fact that sourcing of data to populate and display KPIs is quite challenging due to time and volume of work (i.e. collecting, integrating and validating of data) constraints. As a result, it is prudent to start with a handful of KPIs then build upon it as the measurement approach gains acceptance.
- **Drillable**: Drawing from the paragraph above, on a day-to-day basis, organizations exhibit a dynamic blend of strategy and process. Whiles strategy seeks change, the process seeks stability. In as much as one could represent strategy with a few KPIs, you would need about a hundred or more in monitoring a process. Hence, an effective KPI should parse out KPIs and data based on role, level and task. When one refers to a KPI as being drillable, it means that it must be able to be disintegrated into lesser bits. For instance, at the highest level, executives and managers view graphical representations of KPIs to monitor planned objectives and core processes. Upon identifying a problem, they can now drill down further to subsequent levels in attempts to identify and analyse the roots of the challenge.
- **Simple:** Defining simple in this context represents the fact that KPIs must be readily understood. Workers must fully understand what is being measured and the method of calculation. In short, users are more susceptible to what they can easily understand and relate to. Complex KPIs consisting of indexes, ratios, or multiple depict are difficult to understand and, more importantly, difficult to act on. Also, there is a need to have an effective scoring and encoding system for its relevance in making KPIs simple.
- **Actionable:** Performance management practitioners undervalue the creation of actionable metrics. They need to make users know how their actions positively affect the outcome of KPIs. Sadly, as many organizations publish KPIs, most of their users do not know how to infer from the results and perform the actions needed when KPIs trend downwards. Management must ensure they manage according to the overall trends other than by the current status of a KPI. This avoids the whipsaw effect of management overreacting to a dip in performance which could be as a result of a normal statistical variation rather than a representation of total

failure. A relative problem occurs when an organization publishes KPIs but does not equip users on how to take specific actions.

- **Owned:** The concept of each KPI having a specific owner has a lot to do with accountability. It is imperative that for each KPI there should be a corresponding owner to avoid finger-pointing. This ensures that whoever is in charge remains extremely motivated and responsible for managing the KPI. It is imperative that in managing of KPIs there is a business owner as well as a data owner. The business owner is responsible for the meaning and value of the KPI whereas the data owner is responsible for regular updating of the KPI metrics.
- **Referenced**. Professionals in this sector have come to the realization that when it comes to KPIs if users do not trust the data, they will not use it. The data being used must be clean, accurate, and most importantly, perceived as accurate. Being accurate alone is not enough. Management must find a way to let users believe that the information they are giving is accurate. In lieu of this, a major approach to stimulate trust in your KPIs is to make available reference data about them such as details about the origins, mode of calculation and the other relevant details.
- **Correlated**. This is impeccably one of the most distinct features a KPI. In the long run, they need to impact performance in the right direction. Unfortunately, quite a number of organizations create KPIs but rarely evaluate them after the fact to assess if they correlate with desired statistical outcomes. Should this be done, it makes obvious the distinction between driver KPIs and outcome KPIs which empowers management during decision making. It's imperative to correlate KPIs on a continuous basis in any organization due to the fact that their impact undergoes variations over time as the internal, economic, and competitive values of the organization shifts. Ideally, KPIs have a finite lifespan; most entities derive value from them only in the first years they are made. Afterwards, you need to rejigger the targets or KPIs to sustain progress or move to new KPIs that better reflect the current strategy.
- **Balanced**: Offering a balanced set of KPIs; KPIs should not only focus on a specific dimension of the business but rather it needs to cut across several interlinked dimensions that affect performance: preferably, a KPI should be a perfect mix of these four perspectives. Financial, customer, operation and learning and growth. This approach helps organizations to avoid improvement in one dimension whiles another dimension suffers. This author proposes the usage of a strategy map in identifying leading indicators. On a micro level, it's important that KPIs provide a balanced perspective to individuals whose performance is being monitored. For example, a single KPI may drive behaviour in an unintended direction, which forces managers to introduce a second KPI that balances the first.

- **Aligned:** It is imperative that KPIs are aligned and do not necessarily undermine each other, a phenomenon that some call “KPI sub-optimization.” It is quite difficult to detect KPI sub-optimization unless you put KPIs into play and censor the results. Then, you can identify all the imbalances and make all necessary adjustments. This is why several performance management practitioners caution against striving for KPI perfection but rather get them to a rather confident level and monitor them in practice.
- **Valid:** KPIs must not only be aligned and balanced but also tested to ensure workers cannot circumvent the KPIs out of laziness or greed. Organizations ought to test their KPIs to ensure workers are not implementing any foul processes to affect their outcome without any improvement to the business. A typical way to avoid this problem is to engage employees in defining the KPIs and associated targets before implementation. They know better than anyone the nuances involved in the processes and potential loopholes that may tempt users to play foul. One factor that provokes foul play is when organizations attach monetary incentives to KPIs. As such, it is very necessary to test and validate KPIs in a simulated setting.

5.3.2 Author 2: Project Management Australia Conference (PMOZ)

Mian *et al.*, (2004) stated that the success or failure of any project depends on the definition different people attribute to its factor of measurement. This is so as people define it based on their perceptions and interest with respect to their desired outcomes.

In order to develop common measures without any conflict of interests, it is necessary to state the criteria these measures should meet in order to be considered usable. This has led to the question “what actually qualifies an indicator “as fit” for the evaluation it was created for?”

Mian *et al.*, (2004) identified six critical characteristics of an indicator that would make them applicable, useful, independent and practical for the immediate health assessment of ongoing or historical projects as:

- **Easily measurable**: The ultimate goal of performance indicators is to evaluate and measure performance. Therefore, when developing indicators, it is very crucial to ensure that they can be measured quickly, directly and accurately with as little effort as possible.
- **Broadly applicable:** Indicators must be applicable in the sense that they must be able to be measured at any stage of a project. In the case where different indicators are used at different stages, the combination of indicators must be applicable across all stages of the project and also be able to represent different methods.

- **Assessable:** Once an indicator has been measured, it must be benchmarked against known value on the basis of industry standards and historical data in order to allow for correct judgement to be made.
- **Independent:** Performance indicators should be unique in the sense that they are not duplicates of other variables. This is important to provide clarification during the analysis of a specific indicator. In this way, interferences that yield misleading results can also be completely avoided.
- **Realistic:** The measured indicator must provide a description of reality rather than an imaginary condition. This simply means that indicators must be created to be effective in a real situation.
- **Sensitivity:** Performance indicators must be developed in such a way that it is in tune with the specific project it was designed for in order to allow for an accurate assessment to be carried out.

From the review of Mian *et al.*, (2004) paper, some characteristics of indicators were also identified. They are;

- **Holistic:** This means the indicators must not only be valid for one stage of a project but throughout the whole stages of the project. It also implies that KPIs has to be applicable to a project regardless of whether a performance target was set by an interested party, legislation or by other projects.
- **Useful:** This simply means that indicator must meet the purpose for which they have been created. An evaluation has to be carried out by discussing with the relevant stakeholders to assess its usefulness thereby deciding on how to improve on it if needs be.
- **Specific:** Indicators must precisely define what it aims to measure in order to check the model against the appropriate benchmarks.
- **Validity:** The validity of indicators has to be assessed as it forms part of the tool used to carry out further analysis needed to be assessed. This can be achieved by making sure that they were developed using valid data, have valid data to calculate the metric, and its ability to deliver accurate and valid results.

5.3.3 Author 3: Key Performance Indicators: Developing, Implementing and Using Winning KPIs

Parmenter, (2015) performed extensive analysis and collected primary data from over 3,000 respondents from the public and private sector in his KPI workshop, he came up with the definition of seven characteristics of KPIs which are;

- **Non-Financial:** Organizations have indicators that are sometimes intangible measures but necessary for the overall success of the business. These non-financial indicators are oftentimes difficult to quantify and Parmenter, (2015) argues that all KPIs are non-financial. Simply put, indicators are not to be expressed in dollars, Yen, Pounds, Euros, etc. Parmenter, (2015) gives an example of adding a dollar sign on a measure, this already converts it into a result indicator (e.g., daily sales are a result of activities that have taken place to create the sales). The KPI lies deeper down as it may be the number of visits to contacts with the key customers who make up most of the profitable business.
- **Timely:** It is advised that performance indicators should be tracked 24/7, weekly, or probably monthly and not quarterly or annually. This calls for a need to frequently evaluate its data so as to improve on its performance before it becomes too late to repair.
- **CEO Focus**: The intent for which performance indicators are developed is to make a difference; they are acted upon by the CEO and senior management team who constantly give them attention to make sure they are functional by putting daily calls to the relevant staff.
- **Simple:** A KPI should tell you what action needs to be taken. This simply implies that all staff understand the measure and what corrective action is required. Using The British Airways late-planes KPI to explain this, Parmenter, (2015) explains how it is immediately communicated to all parties involved (i.e., Cleaners, caterers, baggage handlers, flight attendants, and front desk staff) that there needed to be a focus on recovering the lost time. This would prompt them to work some magic to save time while maintaining or improving service standards.
- **Team-based:** Parmenter, (2015) explains that KPIs are deeply rooted in the organization in such a way that it cannot be tied to just one manager but to a whole team. They are developed to be achieved as a result of many activities under different managers. The responsibility can be tied down to a team or a cluster of teams who work closely together.
- **Significant impact/ Realistic:** A KPI will affect one or more of the critical success factors and more than one balanced-scorecard perspective. In other words, when all stakeholders focus on developing the KPIs, the organization scores goals in many directions.
- **Limited dark side/ Measurable:** Before becoming a KPI, a performance measure needs to be tested to ensure that it creates the desired behavioural outcome (e.g., helping teams to align their behaviour in a coherent way to the benefit of the organization). They are developed to ensure that they encourage appropriate action (e.g., have been tested to ensure that they have a positive impact on performance, whereas poorly thought-through measures can lead to dysfunctional behaviour).

5.3.4 Author 4: Key Performance Indicators for Measuring Construction Success

According to Chan and Chan, (2004), the concept of project success is developed to set criteria and standards by which project managers can complete projects with the most favourable outcomes. Chan and Chan, (2004) reiterates Mian *et al.*, (2004) statement that project success means different things to different people and each industry, project team or individual has its own definition of success. Citing an example, architects prioritise aesthetics over building cost as the main criterion for success. Meanwhile, the client may place more value on other dimensions. Moreover, even the same person's perception of success can change from project to project. Therefore, there need to be a set of criteria or characteristics that such performance measures are based on.
(Collin, 2002, as cited in Chan and Chan, (2004) advocates that the process of developing KPIs involved the consideration of the following characteristics;

- **Specific:** KPIs are general indicators of performance that focus on critical aspects of outputs or outcomes. They must be related to a specific area of action.
- **Sparse:** Only a limited, manageable number of KPIs is maintainable for regular use. Having too many (and too complex) KPIs can be time and resource consuming. The fewer the performance indicators used for an evaluation, the easier so as not to confuse the stakeholders and staff with too much information.
- **Holistic:** The systematic use of KPIs is essential as the value of KPIs is almost completely derived from their consistent use over a number of projects.
- **Simple:** Performance indicators must be developed in such a way that data collection must be made as simple as possible. This implies that they must be written clearly for users to understand easily.
- **Flexible**: A large sample size is required to reduce the impact of project-specific variables. Therefore, KPIs should be designed in such a way that they are flexible in nature.
- **Comprehensible:** For performance measurement to be effective, the measures or indicators must be accepted, understood and owned across the organisation.
- **Adaptable**: KPIs will need to evolve and it is likely that a set of KPIs will be subject to change and refinement.
- **Accessible:** Graphic displays of KPIs need to be simple in design, easy to update and accessible.

Selection of Relevant Characteristics

Although a large number of characteristics were identified in the literature review, in order to have a robust, accurate and immediate assessment of the health of the workplace, we had to select the final

set of relevant characteristics based on the frequency they appeared in several works of literature. In the end, six characteristics were selected as shown in Table 10 below.

Table 10: Checklist of KPI Characteristics

Characteristics	**Author**			
	Eckerson (2009)	Mian *et al.*, (2004)	Parmenter, (2015)	Chan and Chan, (2004),
Sparse	✓			✓
Drillable	✓			
Simple	✓		✓	✓
Actionable	✓			
Owned	✓			
Referenced	✓			
Correlated	✓			
Balanced	✓			
Aligned	✓			
Validity	✓	✓		
Measurable		✓	✓	
Applicable		✓		
Assessable		✓		
Independent		✓		
Realistic		✓	✓	
Sensitivity		✓		
Holistic		✓		✓
Useful		✓		
Specific		✓		✓
Non-financial			✓	
Timely			✓	
CEO-Focused			✓	
Team-based			✓	
Flexible				✓
Comprehensible				✓
Adaptable				✓
Accessible				✓

5.4 SELECTION OF KPI

5.4.1 Literature Search of Performance Indicators

Regarding the diversity on the concept of 'healthy work environment' no real consensus on a definition seems to exist. As such in the search for the indicators, an all-inclusive literature search was conducted in Scopus and Web of Science using multiple combinations of the following keywords: **"psychosocial work factors" AND "workplace"; healthy AND organization AND "job stress" AND comfort OR well-being; safe OR healthy AND workplace AND "performance indicators"; "IEQ" OR "Indoor Environmental Quality" AND "workplace" OR "office" AND "indicators" OR factors W/ health; (psychosocial health) AND (Indicator or KPI or Factor) AND (workplace AND Metric) AND (office); (work* OR workplace) AND (health AND metrics OR indicators) AND (performance AND measurement) AND (office AND design) AND (acoustic AND air AND thermal AND light).**

This approach of multiple combinations was borne out of the necessity to limit the document search on indicators or factors specifically associated with both the workplace and health. The range of the search was limited to 2000 – 2019. Although this line of research became predominant after 2010, an attempt was made to identify the efforts made by other researchers prior to 2010. This approach was inclusive but at the same time rigorous in refining our search to the definitive scope. The initial search generated 658 documents in total. 539 citations from 'Scopus' and 119 from 'Web of Science.' Using the research tool 'Zotero', the citations were assessed, and duplicates were merged. This left us with a total of 464 citations. The titles of these 464 were rigorously checked and those that seemed to be more related to a hospital setting or residential were excluded. Furthermore, the documents that seemed unrelated to our search but was included in the search results due to the multiple combinations of keywords were also excluded. After applying the exclusion criteria, only 70 documents remained for an abstract read. The abstracts were reviewed, and the documents schemed through to identify those that were: a) utterly related to the health and well-being of a worker b) listed some indicators or factors and c) were confined to the workplace only. This inclusion criteria generated 15 documents for full text read. In table 11 below, the 15 articles identified for a full text read are shown.

Table 11: KPI literature sources

#	Paper Title	Author Keywords	Source
1	Acoustical planning for workplace health and well-being: A case study in four open-plan offices	Acoustic comfort, workplace, open-plan offices, noise annoyance	(Lee and Aletta, 2019)
2	Development of an Indoor Environmental Quality assessment tool for the rating of offices in real working conditions	Indoor environmental quality, Working conditions, Measurement, Work factors	(Devitofrancesco *et al.*, 2019)
3	Effects of office environment on employee satisfaction: A new analysis	acoustics, green buildings, occupant satisfaction, thermal comfort, post-occupancy evaluation	(Leder *et al.*, 2016)
4	Impact of indoor environmental quality on occupant well-being and comfort: A review of the literature	Indoor environment quality, Occupant comfort, Offices, Occupant well-being	(Al horr *et al.*, 2016)
5	Indicators of healthy work environments – a systematic review	Measuring outcomes, impact, metrics, evaluations, sustainable building, workplace performance	(Lindberg and Vingård, 2012a)
6	Key performance indicators for the indoor environment	Healthy work, healthy workplace, healthy organization, guidelines, employee	(Loomans, 2011)
7	Occupant satisfaction with indoor environmental quality in green buildings	Green Buildings, Indoor Environmental Quality, Post Occupancy Evaluation, Occupant Survey Category	(Abbaszadeh *et al.*, 2006)
8	Perceived importance of the quality of the indoor environment in commercial buildings	assessment scheme, health, psychosocial elements, perceived importance	(Lai and Yik, 2007)
9	Psychosocial work environment and emotional exhaustion among middle-aged employees	Job stress, Psychosocial factors at work, Organizational climate,	(Helkavaara, Saastamoinen and Lahelma, 2011)
10	Psychosocial work factors and sickness absence in 31 countries in Europe	Europe, Psychosocial, Psychophysical, health, illness	(Niedhammer *et al.*, 2013)
11	Psychosocial working conditions and psychological well-being among employees in 34 European countries	Europe; Job stress; Occupation; Psychosocial work factors; WHO-5 index; Well-being	(Schütte *et al.*, 2014a)
12	Satisfaction of occupants toward indoor environment quality of certified green office buildings in Taiwan	Green Buildings, Indoor Environmental Quality, occupant satisfaction,	(Liang *et al.*, 2014)
13	The relationship between psychosocial work factors, work stress and computer-related musculoskeletal discomforts among computer users in Malaysia	Malaysia, Office worker, Psychosocial work factors, Work stress, Musculoskeletal discomfort	(Zakerian and Subramaniam, 2009)
14	Using common work environment metrics to improve performance in healthcare organizations	Performance Metrics, Healthy work environments, Organizational Performance	(Lowe and Chan, 2010a)
15	Workplace alignment: An evaluation of office worker flexibility and workplace provision	Activity-based working, Flexible working, Location flexibility	(Haynes, Suckley and Nunnington, 2019)

As shown in Table 11, these 15 documents were thoroughly read, analysed and purposely reviewed to explicitly select those that categorically identified indicators necessary to our study. A total of 6 documents were henceforth selected for the identification of the indicators. In the earlier selection processes, the research was restricted to the workplace but the article by Lowe and Chan (2010) was identified as using the common work environment metrics and as such justifiable in the inclusion criteria. Subsequently, a spontaneous google search was made to identify a few reports that may be credible but did not come up in our earlier search. 3 peculiar reports (as highlighted in Table 11) were found to be representative of workplace health indicators and thus added to our documents. In conclusion, a total of 9 documents were adapted and used in this study for the selection of the KPIs as shown in Table 12 below. Also, the selection procedure is represented in the form of the PRISMA framework in figure 10 below.

Table 12: Final Sources of KPI

#	Title of publication	Year	Author	Type of source	Keywords
1	Acoustical planning for workplace health and well-being: A case study in four open-plan offices	2019	Young Lee & Francesco Aletta	Research paper	Acoustic comfort, workplace, open plan offices, noise annoyance
2	Health and Productivity in Sustainable Buildings	2015	Katarzyna Chwalbińska-Kusek, Małgorzata Olszewska	White paper	Measuring outcomes, impact, metric, evaluations, sustainable building, workplace performance
3	Health, Wellbeing & Productivity in Offices	2014	John Alker, Michelle Malanca, Chris Pottage, Rachael O'Brien	Report	Green building, tracking impacts, measuring organizational outcomes, performance-related metrics, measurement
4	Indicators of a thriving workplace strategy	2018	SuperFriend National Mental Health Organization	Report	Mental Health, well-being, Job stress , workplace environment
5	Indicators of healthy work environments – a systematic review	2012	Per Lindberga, & Eva Vingårda	Conference paper	Healthy work,healthy workplace, healthy org anization, guidelines, employee
6	Key performance indicators for the indoor environment	2011	Marcel Loomans, Aapo Huovila, Pierre-Henri Lefèbvre, Janne Porkka, Pekka Huovila, Jan Desmyter, Asher Vaturi	Conference paper	Indoor environment, performance in dicators, perfection, health, comfort, safety, accessibility, functionality, positive Stimulation
7	Psychosocial working conditions and psychological well-being among employees in 34 European countries	2014	Stefanie Schutte, Jean-Francois Chastang, Lucile Malard, Agnes Parent-Thirion, Greet Vermeylen, Isabelle Niedhammer	Journal article	Europe, job stress, occcupation, psychosocial work factors, WHO-5ind ex, well-being
8	Occupant satisfaction with indoor environmental quality in green buildings	2006	Abbaszadeh, S. Zagreus, Leah Lehrer, D. et al.	Report	Green buildings, indoor environment al quality, post occupancy evaluation, occupant survey category
9	Using Common Work Environment Metrics to Improve Performance in Healthcare Organizations	2010	Graham S Lowe & Ben Chan	Journal article	Performance metrics, healthy work environments, organizational performance

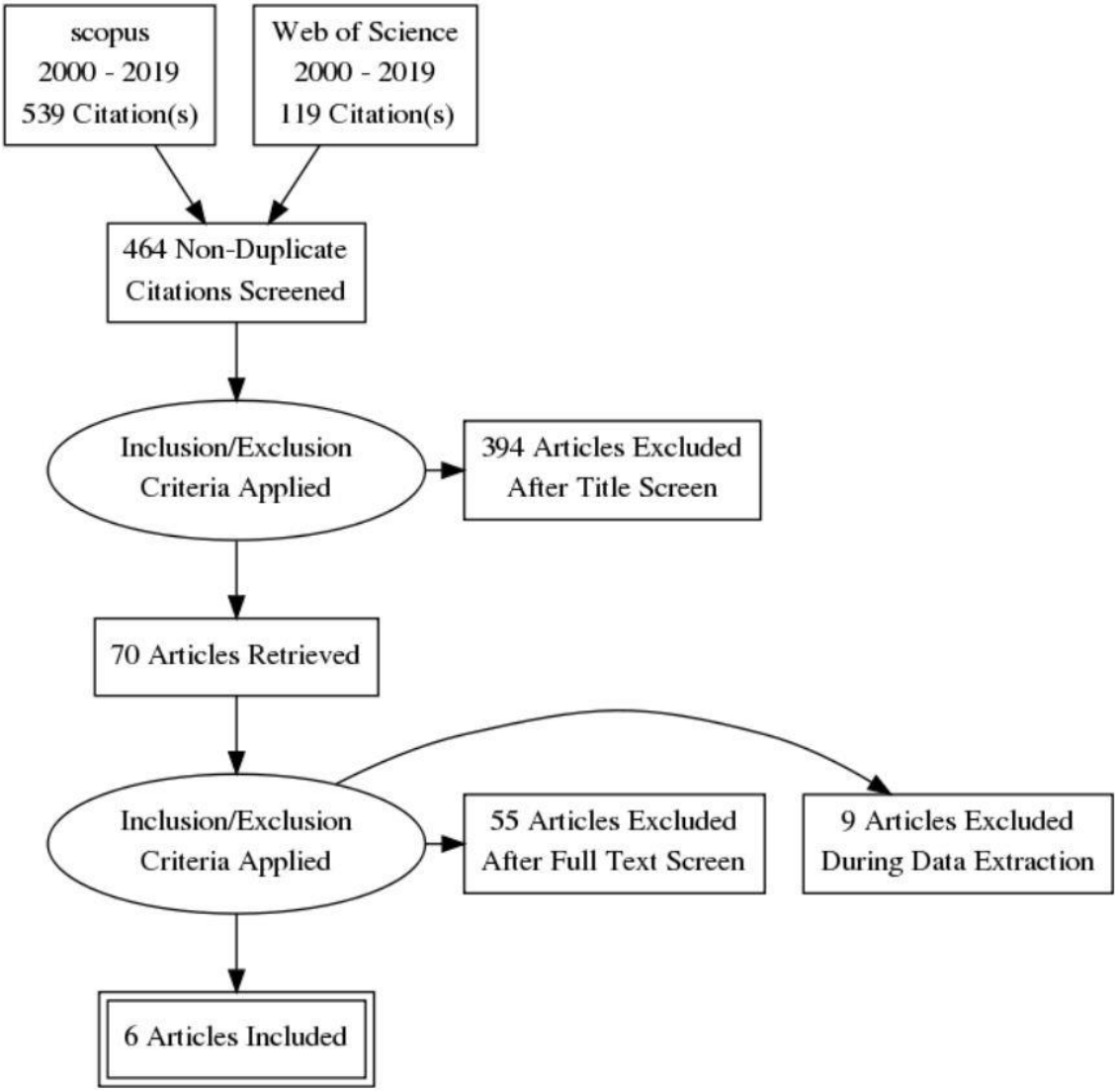

Figure 10: The Prisma Framework representation for the Selection of Indicator Sources

Analysis of KPI sources list

The publications on the KPIs sources shows that the choice of indicators was made by conducting a study based on literature review; or via surveys using questionnaires, online or face-to-face-interviews, discussion with focus group experts; or both. The experts involved in some of these studies were specialised in architecture, design, facility management, human resource management in health and well-being enhanced workplaces in line with the purpose of this research study. 4 papers out of the 9 selected were reporting on psychosocial work factors while the remaining 5 were on indoor door environmental quality. These study and surveys were conducted with the workers, employees, employers and experts as respondent.

Lee and Aletta (2019) presented only indicators relating to acoustic control as their study was specially geared to deal with noise in open-plan offices. The KPIs identified are: spatial zoning and planning, technical measures, construction detailing methods and workplace etiquette policy to mitigate noise issues and provide speech privacy.

Chwalbińska-Kusek and Olszewska, (2015) provided the list of KPIs that dealt with organisational metrics, perceptual metrics and physical metrics. Survey results by Alker *et al.* (2014b) is also closely related to these metrics as they measure the organisational outcomes and relating these outcomes back to the physical features of buildings and employee perceptions. Both papers focus on sustainable buildings. However, for the purpose of our research, we considered just the indicators relating to physical metrics and perceptual metrics.

Abbaszadeh *et al.*, (2006) work is focused on indoor environmental quality conditions in green building. They provided objective data such as work type, office type, proximity to a window, etc., in addition to the subjective responses such as perceived satisfaction given. Loomans (2011) also presented an overall quality of the indoor environment in buildings where emphasis was on a variety of issues such as comfort, health and safety.

SuperFriend. Indicators of a Thriving Workplace Survey. Melbourne (2018) compiled a long list of 40 scientifically validated indicators which were presented across five essential domains for building thriving workplaces: leadership, connectedness, policy, capability and culture. These indicators are related to psychosocial health as they were selected as regards mental health. Schütte *et al.* (2014) also provided indicators that confirmed this.

According to Lindberg and Vingård (2012), only one study was identified that explicitly investigated indicators of a healthy work environment. However, this has changed over the years as evident with the other sources provided in this analysis. They presented the nine most pronounced components identified to achieve a healthy workplace in descending order: collaboration/teamwork; growth and development of the individual; recognition; employee involvement; positive, accessible and fair leader; autonomy and empowerment; appropriate staffing; skilled communication; and safe physical work.

Lowe and Chan (2010) gave a concise representation of KPIs. They proposed a three-tiered hierarchy of indicators. The top will be for organization leaders with key target items, the middle will contain KPI drivers and the third which is the most detailed will contain indicators (such as: role clarity, recognition and feedback, job demands, supervisor support and other jobs, work environment and HR factors) necessary to drive improvements in communication and work-life balance.

From the sources listed above, the number of performance indicators selected is 147, with 4 as the minimum number collected from each source and 30 as the maximum number collected. These indicators were checked and found to have met with the criteria of relevant characteristics earlier listed in table 10. They were also selected giving relevance to the purpose of this research.

5.4.2 Description of KPI sources

Indicators from Lee and Aletta (2019)

An easy-to-use assessment tool to help practitioners design more acoustically sensible spaces was proposed by these authors. They started off with identifying a couple of indicators relevant to workplace health and well-being, and then, interviewed a focus group of 17 leading practitioners in the architecture, design, facility management, health and well-being enhanced workplaces to review and finalize the KPIs from all the listed indicators. They considered acoustic performance-related KPIs are under physical comfort and cognitive well-being and a total of four KPIs for acoustic planning and strategies for workplace health and well-being under these two dimensions. Nineteen items were adopted within these four topics. The principle of establishing these measures was to identify acoustic strategies from a multi-layered approach to tackle a complex issue of noise control, speech privacy and supporting concentration work in the prevalent open-plan workplaces without relying on only one-dimensional acoustic solutions. Thus, this paper provides KPIs that address an acoustic environment in the workplace through four approaches including spatial zoning and planning, technical measures, construction detailing methods and workplace etiquette policy to mitigate noise issues and provide speech privacy. In general, this kind of assessment also offers an opportunity for reflection about whether certified buildings that are efficient according to established protocols actually also achieve high performances in terms of indoor environmental quality from the occupants' perspective, as a holistic approach.

Table 13: Indicators #1-4

#	Indicators from Lee and Aletta (2019)	Code	Source
1	Space planning principles to contain unwanted sounds,	AC	(Lee and Aletta, 2019)
2	Technical measures for indoor noise control	AC	
3	Construction methods for sound control	AC	
4	Acoustic privacy: occupant noise control in open spaces	AC	

Indicators by Chwalbińska-Kusek and Olszewska, (2015)

The indicators derived in this white paper span across multiple dimensions of health in the workplace. By the relevant coding, it was realized that this paper identified all domains of the Indoor Environmental Quality. The link between worker health and their productivity in the workplace was the key objective of this paper. As such, they developed this list, based on a consultation of over 50 industry players related to the workplace health. These experts and partners undertook a review of the World Green Building Council (WGBC) methodology and finalized on this list of indicators that can aid organizations implement the changes needed for improved worker health and well-being.

Table 14: Indicators #5-33

#	Indicator from (Chwalbińska-, Kusek and Olszewska, 2015)	Code	Source
5	Natural Ventilation or mixed-mode system	AQ	(Chwalbińska-, Kusek and Olszewska, 2015
6	Ceiling Heights	AQ	
7	Building Materials	AQ	
8	Dedicated Exhaust ventilation to print rooms	AQ	
9	Specification of low and zero-emission carpets and suspended ceilings	AQ	
10	Specification of low or zero-emission finishes and adhesives	AQ	
11	Air Quality Sensors (CO2) and variable ventilation intensity	AQ	
12	Sensor technology and zoned controls ensuring the comfort of individuals or small groups	TC	
13	Adjustable external blinds connected to daylight sensors	TC	
14	Luminance levels appropriate to tasks	VC	
15	High colour rendition	VC	
16	High-frequency and efficient lights	VC	
17	Limited glare and good visual comfort	VC	
18	Presence detectors, colour changing and daylight-linking	VC	
19	Artificial lighting control zoning	VC	
20	Daylight/glare controls	VC	
21	Appropriate sound absorption of the room provided through absorbent materials on surfaces depending on the room and its function	AC	
22	Controlled background noise level suitable for certain activity or room typology	AC	
23	Providing the need for concentration and privacy on the one hand and the desire for openness and communication on the other	AC	
24	A range of different workspaces providing various levels of acoustic privacy	AC	
25	Task-based and social spaces	ODL	
26	Active design	ODL	
27	Longer distance views away from computer or written documents allowing the eyes to adjust and re-focus	ODL	
28	View out to nature	ODL	
29	Low-energy lighting strategy	OTHERS	
30	Materials low in volatile organic compounds (VOCs)	OTHERS	
31	Easy to clean	OTHERS	

32	Low-VOCs cleaning	OTHERS	
33	Adjusting ceiling height to nature of tasks — high for creative tasks, low for accuracy-based (impact on HVAC strategy)	OTHERS	

Indicators by Abbaszadeh et al., (2006)

The aim of this report was to assess occupant satisfaction in green building with more specificity on the IEQ conditions of their place of work. In addition to the subjective responses such as perceived satisfaction given, objective data such as work type, office type, proximity to a window, etc., were all recorded and analysed statistically. Consequently, these set of indicators were identified as being KPIs for worker health satisfaction. The results suggest a need for improvements in controllability of lighting and innovative strategies to accommodate sound privacy needs in open-plan or cubicle office layouts in both comparison groups.

Table 15: Indicators #34 - 39

#	**Indicators from** (Abbaszadeh *et al.*, 2006b)	**Code**	**Source**
34	Office Layout	ODL	(Abbaszadeh et al., 2006)
35	Office Furnishings	ODL	
36	Thermal Comfort	TC	
37	Air Quality	AQ	
38	Lighting	VC	
39	Acoustics	AC	

Indicators by Alker et al. (2014b)

This WGBC report of 2014 was addressed towards the provision of improvement strategies on organizations' biggest expenditure which are people and places and the relationship between the two. This report came about as organizations tried to understand how their buildings impacted the health and well-being of their people. It focused on measuring organisational outcomes and relating those back to the physical features of buildings and employee perceptions. The WGBC then developed a framework to assess this demand by organizations and among them.

Table 16: Indicators #40 – 69

#	**Indicators from** (Alker *et al.*, 2014a)	Code	Source
40	Pollutants, including VOCs	AQ	(Alker *et al.*, 2014)
41	CO2	AQ	
42	Aroma	AQ	
43	Ventilation rate or fresh air	AQ	
44	Moisture content	AQ	
45	Indoor air temperature	TC	
46	Mean radiant temperature	TC	
47	Air velocity	TC	
48	Relative humidity	TC	
49	Clothing	TC	
50	Activity	TC	
51	Quantity	VC	
52	Quality	VC	
53	Glare	VC	
54	Daylight	VC	
55	Task type	VC	
56	Background noise	AC	
57	Privacy & interference	AC	
58	Vibration	AC	
59	Workstation density	ODL	
60	Task based spaces & ergonomics	ODL	
61	Breakout spaces and social features	ODL	
62	Active design	ODL	
63	Connections to nature	ODL	
64	Views outside	ODL	
65	Design character & brand ethos, including colour, shape, texture & art	OTHERS	
66	Cultural, gender & age sensitive design	OTHERS	
67	Access to amenities	OTHERS	
68	Transport	OTHERS	
69	Quality of public realm	OTHERS	

Indicators by Loomans (2011)

In this paper, a set of performance indicators to assess the overall quality of the indoor environment in buildings were developed. The paper focused on a variety of issues such as comfort, health and safety. A comprehensive literature review was conducted, and examples of indicators were described as were an evaluation procedure for assessing the workplace health. A list of indicators was selected as first proposal from the PERFECTION framework and regarded as Key Indoor Performance Indicators (KIPI's). Subsequently, the list was assessed by different experts in different settings through interviews, survey, workshops and case studies.

Table 17: Indicators #70 – 79

#	Indicators from (Loomans, 2011)	Code	Source
70	Mould growth risk 2.	AQ	(Loomans, 2011)
71	Ventilation / CO2 3.	AQ	
72	Combustion sources / infiltration	AQ	
73	Particulate matter	AQ	
74	Drinking water quality	OTHERS	
75	Operative temperature / PPD	TC	
76	Illuminance	VC	
77	Daylight factor	VC	
78	Background noise level	AC	
79	Reverberation time	AC	

Indicators by SuperFriend. Indicators of a Thriving Workplace Survey. Melbourne (2018)

SuperFriend is Australia's national mental health agency that promotes positive change in mental health and well-being in the workplace. They conducted a research involving more than 5,000 Australian workers from a wide range of industries and occupations. They tracked the progress of mental health and well-being against an ideal or desired state. At the end of the survey, 40 scientifically validated indicators were presented across five essential domains for building thriving workplaces: leadership, connectedness, policy, capability and culture.

Table 18: Indicators #80 – 84

#	Indicator from SuperFriend National Mental Health Organization	Code	Source
80	Leadership	LP	**SuperFriend National Mental Health Organization**
81	Connectedness	CON	
82	Policy	POL	
83	Capability	JD	
84	Culture	CUL	

Indicators by Lowe and Chan (2010)

This analysis began by summarizing healthcare studies on healthy work environments (HWE), comparing concepts and methods used to evaluate HWE in healthcare settings. A guiding HWE model was developed and a three-tiered hierarchy of indicators was proposed. KPIs at the top of the hierarchy are of concern to organization leaders, so the items represent key targets. KPI drivers are included in the mid-level down the hierarchy. The choice of mid-level metrics represents the organization's quality improvement strategy. The third tier is indicators that would be tracked by specific HR functions related to the work environment which could lead to improvements in the mid-level indicators. Stakeholders interested in HWEs must, however, come together to weigh the pros and cons of each option and agree on a standardized approach. They agreed that an HWE common metrics program requires people who can communicate the urgency and benefits of its application and ensure the HWE framework must be aligned with existing quality frameworks. In order to avoid survey fatigue, organizations that already conduct surveys could incorporate core indicators into existing surveys, perform sample surveys, conducting different surveys on alternate years, moving to a 12-month data collection process where a different unit is surveyed each month or transitioning from the existing survey to the new tool over time. For the reporting system, they suggested an annual HWE report card can be launched and high-level indicators from this report card can be integrated into existing quality reporting mechanisms. They proposed a five-year reporting system is to tracks trends, provide meaningful comparisons across organization types and jurisdictions, and offer helpful insights about effective HWE practices.

Table 19: Indicators #85 – 113

#	**Indicators from** (Lowe and Chan, 2010a)	Code	Source
85	Patient/client satisfaction	OTHERS	(Lowe and Chan, 2010) Organizations
86	Patient safety	OTHERS	
87	Perceived quality of care delivered	OTHERS	
88	Retention	POL	
89	Absenteeism	CUL	
90	Injury costs	OTHERS	
91	Engagement	CON	
92	Job satisfaction	CUL	
93	Work-life balance	CUL	
94	Worker safety	POL	
95	Decision input	CUL	
96	Communication	CON	
97	Respectful and trusting relationship	CUL	
98	Supportive supervisor	LP	
99	Supportive co-workers	CON	
100	Healthy and safe environment	POL	

101	Collaboration	CUL	
102	Recognition and feedback	POL	
103	Fair processes	CUL	
104	Learning and development opportunities	POL	
105	Job control	LP	
106	Job resources	POL	
107	Job demands	JD	
108	Role clarity	LP	
109	Skill utilization	JD	
110	Strategic human resource approach Workplace health promotion	POL	
111	Occupational health and safety management system	POL	
112	Culture	CUL	
113	Leadership	LP	

Indicators by Schütte et al. (2014)

This study was conducted based on data from the 2010 European Survey of Working Conditions. It was conducted was to explore the associations between psychosocial working conditions and psychological well-being among employees in 34 European countries and to also examine whether these associations varied according to occupation and country. The survey was carried out through face-to-face interviews based on a questionnaire. The model used was multi-stage, stratified, and clustered, and the sample was confined to individuals who served as workers. At the end of the survey, results show that almost no country differences were observed in the associations between psychosocial work factors and well-being suggesting that these factors were associated with well-being in a similar way according to country.

Table 20: Indicators #114 – 121

#	**Indicators from** (Schütte *et al.*, 2014)	**Code**	**Source**
114	Job demands	JD	(Schütte et al., 2014)
115	Influence and development	POL	
116	Social relationships and leadership	LP	
117	Workplace violence	CUL	
118	Working hours	POL	
119	Job promotion	POL	
120	Insecurity at work	CUL	
121	Work-life imbalance	JD	

Indicators by Lindberg and Vingård (2012)

The purpose of this paper was to present indicators of healthy work environments. To achieve this, a systematic review of scientific literature, searching for indicators of healthy work environments was conducted. This search of major national and international databases from 1990 to 2011 covering different disciplines, methodologies and literature produced 24 peer-reviewed publications after removing duplicates, non-relevant publications, or publications that did not meet the inclusion criteria. The authors found that organizations that offered stress management programs also offered other programs to facilitate worker safety, health, well- being, and skill development. In this respect, the presence of a stress management program appeared to be an indicator of a 'better place to work'.

Table 21: Indicators #122 – 147

#	**Indicators from** (Lindberg and Vingård, 2012a)	Code	Source
122	Use of personal qualities	JD	(Lindberg and Vingård, 2012)
123	In line w. personal values	CUL	
124	Recognition	POL	
125	Treated with respect	CUL	
126	Autonomy, empowerment	CUL	
127	Control at work	JD	
128	Role clarity	LP	
129	Clarity of expectations & goals	LP	
130	Reward strategies	POL	
131	Growth & development	POL	
132	Intellectually stimulating	CON	
133	Employee involvement	CON	
134	Collaboration/teamwork	CUL	
135	Skilled communication	CON	
136	Quick problem solving	JD	
137	Accessible & fair leader	LP	
138	Positive & social climate	CUL	
139	Reasonable work load	JD	
140	Work content	JD	
141	Safe physical work	JD	
142	Appropriate staffing	LP	
143	Adm./personal support	LP	
144	Working time schedule	JD	
145	Work-life balance	CUL	
146	Relations to stakeholders	LP	
147	Benefit to society	POL	

5.4.3 Content Analysis on selected Performance Indicators

In this section, we shall use Erlingsson and Brysiewicz (2017) hands-on theoretical framework for the analysis of qualitative data from relevant literature. The total one-hundred and forty-seven (147) KPIs identified were grouped into common domains. This grouping was done by reading through all the indicators and associating the ones with same theme together. These domains were then assigned codes for easy identification. In the end, we identified eleven distinct domains that would help in the next stages of our analysis. The description of these domains and how they were distributed is shown below.

1. Air Quality (AQ): This contains 17 indicators referring to the condition of the air within the building. It includes indicators like: ventilation rate or fresh air, moisture content, particulate matter, etc.
2. Thermal Comfort (TC): This was used to group indicators relating to the mind perception of satisfaction as relates to the thermal environment of an occupant in a building. Indicators in this domain were 10 and they include: adjustable external blinds connected to daylight sensors, air velocity, etc.
3. Acoustic Control (AC): This refers to 14 indicators relating to how the building is designed to reduce the sound that induces stress reactions and decreases sense of general well-being. The indicators include: technical measures for indoor noise control, unwanted sound, etc.
4. Visual Comfort (VC): 15 Indicators referring to quantity and quality of light within the building was grouped under this domain. They include: high colour rendition, luminance levels appropriate to tasks, high-frequency and efficient lights, etc.
5. Office Design and Layout (ODL): This contains 12 indicators referring to the method an organization has arranged the workplace for ease of movement and zoning of areas to support activities. It includes indicators like: active design, task-based and social spaces, etc.
6. Connectedness (CON): This contains 7 Indicators referring to how workers communicate and cooperate among themselves. It includes: supportive co-workers, skilled communication, etc.
7. Leadership (LP): This refers to 12 indicators that describe how effective leadership support help workers in carrying out the job. The indicators include: Adm. /personal support, relation to stakeholders, accessible & fair leader, etc.
8. Culture (CUL): This is used to group 17 indicators that describe the patterns an organization has developed to cope with issues related to its employees. They include: work-life balance, positive & social climate, etc.

9. Policy (POL): This refers to 16 indicators relating to how the organization can make provisions that will be beneficial to both the employees and society at large. The indicators include: benefits to society, reward strategies, growth & development, etc.
10. Job Demand (JD): This contains 12 indicators referring to the physical and psychosocial aspects of a job that requires continuous efforts. The indicators include: job content, reasonable workload, etc.
11. Others (OTHERS): This contains 15 indicators that were not directly related to the context of this research paper. They include: cultural, gender & age-sensitive design, injury costs, etc.

This information with their respective distribution is represented in figure 11 below.

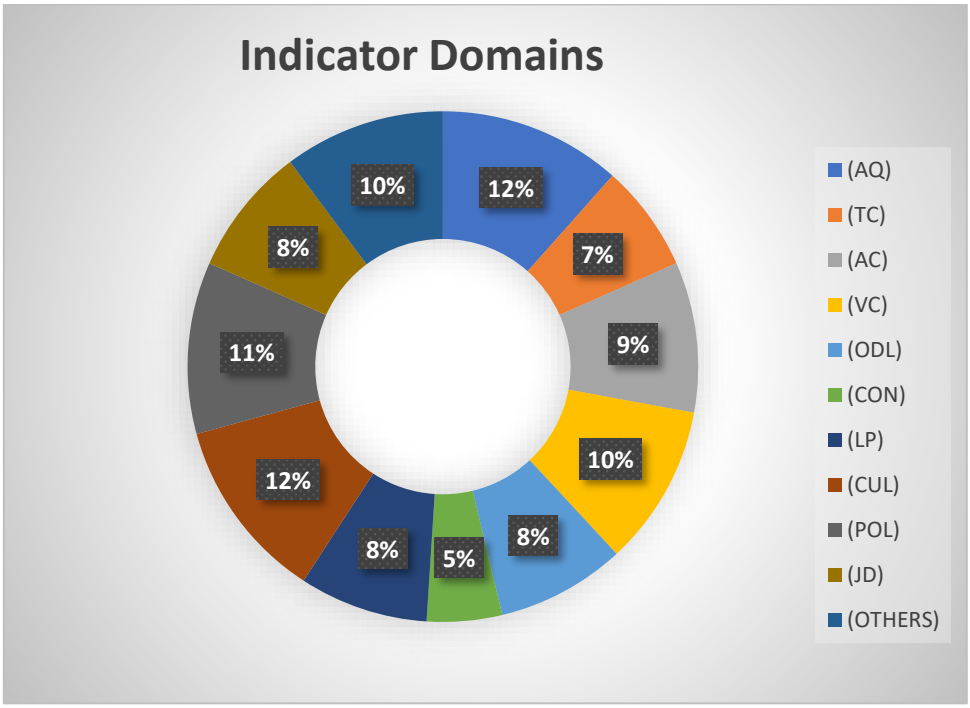

Figure 11: Indicator Domain Distribution

In table 22 below, the relevant indicators are seen to be linked to the articles they were derived from. After listing all the indicators, we checked for duplicates and realised that 5 of the listed indicators were present in other papers. They were immediately excluded, and our indicator list dropped to 142.

Table 22: Summary of Indicators sources and relevant domains present in each source

Source	Indicator domain	No. of indicators
(Lee and Aletta, 2019)	AC	4
(Chwalbińska-, Kusek and Olszewska, 2015)	AC, AQ, TC, VC, ODL	29
(Alker et al., 2014a)	AC, AQ, TC, VC, ODL	30
(SuperFriend. Indicators of a Thriving Workplace Survey. Melbourne, 2018)	LP, CON, POL, JD, CUL	5
(Lindberg and Vingård, 2012a)	LP, CON, POL, JD, CUL	26
(Loomans, 2011)	AC, AQ, TC, VC	10
(Schütte et al., 2014a)	LP, POL, JD, CUL	8
(Abbaszadeh et al., 2006)	AC, AQ, TC, VC, ODL	6
(Lowe and Chan, 2010a)	LP, CON, POL, JD, CUL	29
Total Sum		**147**

Condensation

According to Erlingsson and Brysiewicz (2017), condensation is described as, "a process of shortening the text while still preserving the core meaning." Prior to the condensation process, two actions were performed with the assistance of our initially assigned codes: indicators that were similar and in the same domain was searched for and also, the indicators in each domain were assessed to identify those that were synonymous to each other. After identifying all these features of our data set, the actual condensation begun.

All indicators that meant the same thing but just varied in the caption by the different authors were rephrased in this condensation phase. As shown in the table 23, all the 142 indicators are represented again on the side using their condensed names.

Table 23: List of Condensed Indicators

#	Original Indicators from (Lee and Aletta, 2019)	Code	Condensed Names	Source
1	Space planning principles to contain unwanted sounds,	AC	Acoustic Control via space planning	(Lee and Aletta, 2019)
2	Technical measures for indoor noise control	AC	Acoustic Control via space planning	
3	Construction methods for sound control	AC	Construction methods for acoustic control	
4	Acoustic privacy: occupant noise control in open spaces	AC	Acoustic Control via space planning	

#	Indicator from (Chwalbińska-, Kusek and Olszewska, 2015)	Code	Condensed Names	Source
5	Natural Ventilation or mixed mode system	AQ	Adequate Natural Ventilation	(Chwalbińska-, Kusek and Olszewska, 2015
6	Ceiling Heights	AQ	Appropriate Design Technology for maintaining adequate Air Quality	
7	Building Materials	AQ	Appropriate Design Technology for maintaining adequate Air Quality	
8	Dedicated Exhaust ventilation to print rooms	AQ	Appropriate Design Technology for maintaining adequate Air Quality	
9	Specification of low and zero-emission carpets and suspended ceilings	AQ	Appropriate Design Technology for maintaining adequate Air Quality	
10	Specification of low or zero-emission finishes and adhesives	AQ	Usage of zero-emission finishes /VOC control	
11	Air Quality Sensors (CO2) and variable ventilation intensity	AQ	Appropriate Design Technology for maintaining adequate Air Quality	
12	Sensor technology and zoned controls ensuring comfort of individuals or small groups	TC	Means of Regulating Thermal Control	
13	Adjustable external blinds connected to daylight sensors	TC	Design Provision of Thermal Control	
14	Luminance levels appropriate to tasks	VC	Adequate Luminance Levels for Tasks	
15	High colour rendition	VC	Adequate Luminance Levels for Tasks	
16	High-frequency and efficient lights	VC	Adequate Luminance Levels for Tasks	
17	Limited glare and good visual comfort	VC	Limited Glare	
18	Presence detectors, colour changing and daylight-linking	VC	Appropriate Technology for Visual Comfort	
19	Artificial lighting control zoning	VC	Appropriate Technology for Visual Comfort	
20	Daylight/glare controls	VC	Limited Glare	
21	Appropriate sound absorption of the room provided through absorbent materials on surfaces depending on the room and its function	AC	Construction methods for acoustic control	
22	Controlled background noise level suitable for certain activity or room typology	AC	Acoustic Control via space planning	
23	Providing the need for concentration and privacy on the one hand and the desire for openness and communication on the other	AC	Acoustic Control via space planning	
24	A range of different work spaces providing various levels of acoustic privacy	AC	Acoustic Control via space planning	
25	Task-based and social spaces	ODL	Flexibility and Provision of Social Spaces	
26	Active design	ODL	Flexibility and Provision of Social Spaces	
27	Longer distance views away from computer or written documents allowing the eyes to adjust and re-focus	ODL	Workstation Ergonomic Design Comfort	
28	View out to nature	ODL	Feel of Nature	
29	Low-energy lighting strategy	OTHERS	Appropriate Technology for Visual Comfort	
30	Materials low in volatile organic compounds (VOCs)	OTHERS	Usage of zero-emission finishes /VOC control	
31	Easy to clean	OTHERS	DEL	
32	Low-VOCs cleaning	OTHERS	Usage of zero-emission finishes /VOC control	
33	Adjusting ceiling height to nature of tasks — high for creative tasks, low for accuracy-based (impact on HVAC strategy)	OTHERS	Workstation Ergonomic Design Comfort	

#	**Indicators from** (Abbaszadeh *et al.*, 2006b)	Code	Condensed Names	Source
34	Office Layout	ODL	Flexibility and Provision of Social Spaces	(Abbaszadeh et al., 2006)
35	Office Furnishings	ODL	Workstation Ergonomic Design Comfort	
36	Thermal Comfort	TC	Design Provision of Thermal Control	
37	Air Quality	AQ	Appropriate Design Technology for maintaining adequate Air Quality	
38	Lighting	VC	Adequate Luminance Levels for Tasks	
39	Acoustics	AC	Construction methods for acoustic control	

#	**Indicators from** (Alker *et al.*, 2014a)	Code	Condensed Names	Source
40	Pollutants, including VOCs	AQ	Usage of zero-emission finishes /VOC control	(Alker *et al.*, 2014)
41	CO2	AQ	Appropriate Design Technology for maintaining adequate Air Quality	
42	Aroma	AQ	Usage of zero-emission finishes /VOC control	
43	Ventilation rate or fresh air	AQ	Adequate Natural Ventilation	
44	Moisture content	AQ	Absence of conditions for Mould Growth	
45	Indoor air temperature	TC	Design Provision of Thermal Control	
46	Mean radiant temperature	TC	Design Provision of Thermal Control	
47	Air velocity	TC	Design Provision of Thermal Control	
48	Relative humidity	TC	Design Provision of Thermal Control	
49	Clothing	TC	Means of Regulating Thermal Control	
50	Activity	TC	Means of Regulating Thermal Control	
51	Quantity	VC	Adequate Luminance Levels for Tasks	
52	Quality	VC	Appropriate Technology for Visual Comfort	
53	Glare	VC	Limited Glare	
54	Daylight	VC	Adequate Luminance Levels for Tasks	
55	Task type	VC	Adequate Luminance Levels for Tasks	
56	Background noise	AC	Acoustic Control via space planning	
57	Privacy & interference	AC	Acoustic Control via space planning	
58	Vibration	AC	Construction methods for acoustic control	
59	Workstation density	ODL	Workstation Ergonomic Design Comfort	
60	Task based spaces & ergonomics	ODL	Workstation Ergonomic Design Comfort	
61	Breakout spaces and social features	ODL	Flexibility and Provision of Social Spaces	
63	Connections to nature	ODL	Feel of Nature	
64	Views outside	ODL	Feel of Nature	
65	Design character & brand ethos, including colour, shape, texture & art	OTHERS	Workstation Ergonomic Design Comfort	
66	Cultural, gender & age sensitive design	OTHERS	Cultural, gender & age sensitive design	
67	Access to amenities	OTHERS	Access to amenities	
68	Transport	OTHERS	Transport	
69	Quality of public realm	OTHERS	Quality of public realm	

#	Indicators from (Loomans, 2011)	Code	Condensed Names	Source
70	Mould growth risk 2.	AQ	Absence of conditions for Mould Growth	(Loomans, 2011)
71	Ventilation / CO2 3.	AQ	Adequate Natural Ventilation	
72	Combustion sources / infiltration	AQ	Appropriate Design Technology for maintaining adequate Air Quality	
73	Particulate matter	AQ	Usage of zero-emission finishes /VOC control	
74	Drinking water quality	OTHERS	Drinking water quality	
75	Operative temperature / PPD	TC	Means of Regulating Thermal Control	
76	Illuminance	VC	Adequate Luminance Levels for Tasks	
77	Daylight factor	VC	Adequate Luminance Levels for Tasks	
78	Background noise level	AC	Acoustic Control via space planning	
79	Reverberation time	AC	Construction methods for acoustic control	

#	Original Indicators from SuperFriend National Mental Health Organization	Code	Condensed Names	Source
80	Leadership	LP	Leadership	SuperFriend National Mental Health Organization
81	Connectedness	CON	Cooperation among workers	
82	Policy	POL	Organizational influence	
83	Capability	JD	Role clarity	
84	Culture	CUL	Culture	

#	Original Indicators from (Lowe and Chan, 2010) Organizations	Code	Condensed Names	Source
85	Patient/client satisfaction	OTHERS	Patient/client satisfaction	(Lowe and Chan, 2010) Organizations
86	Patient safety	OTHERS	Patient safety	
87	Perceived quality of care delivered	OTHERS	Perceived quality of care delivered	
88	Retention	POL	Worker retention	
89	Absenteeism	CUL	Job satisfaction	
90	Injury costs	OTHERS	DEL	
91	Engagement	CON	Participation in decision-making	
92	Job satisfaction	CUL	Job satisfaction	
93	Work-life balance	CUL	Work-life balance	
94	Worker safety	POL	Worker safety	
95	Decision input	CUL	Participation in decision-making	
96	Communication	CON	Communication	
97	Respectful and trusting relationship	CUL	Respectful and trusting relationship	
98	Supportive supervisor	LP	Supportive supervisor	
99	Supportive co-workers	CON	Cooperation among workers	
100	Healthy and safe environment	POL	Safe working environment	
101	Collaboration	CUL	Collaboration	
102	Recognition and feedback	POL	Recognition & feedback	
103	Fair processes	CUL	Fair processes	
104	Learning and development opportunities	POL	Growth & Development	
105	Job control	LP	Job control	
106	Job resources	POL	Job resources	
107	Job demands	JD	Job demands	

108	Role clarity	LP	Role clarity	
109	Skill utilization	JD	Workers growth and development	
110	Strategic human resource approach Workplace health promotion	POL	Safe working environment	
111	Occupational health and safety management system	POL	Safe working environment	

#	Indicator from (Schütte et al., 2014)	Code	Source	
115	Influence and development	POL	Influence & involvement	(Schütte et al., 2014)
116	Social relationships and leadership	LP	Leadership	
117	Workplace violence	CUL	Workplace violence	
118	Working hours	POL	Working hours	
119	Job promotion	POL	Recognition & reward	
120	Insecurity at work	CUL	Safe working environment	
121	Work-life imbalance	JD	Workload management	

#	Original Indicators from (Lindberg and Vingård, 2012)	Code	Condensed Names	Source
122	Use of personal qualities	JD	Treated with respect	(Lindberg and Vingård, 2012)
123	In line w. personal values	CUL	Treated with respect	
124	Recognition	POL	Recognition & feedback	
125	Treated with respect	CUL	Treated with respect	
126	Autonomy, empowerment	CUL	Flexible working	
127	Control at work	JD	Flexible working	
129	Clarity of expectations & goals	LP	Role clarity	
130	Reward strategies	POL	Reward Strategies	
131	Growth & development	POL	Growth & Development	
132	Intellectually stimulating	CON	Workers Development	
133	Employee involvement	CON	Participation in decision-making	
134	Collaboration/teamwork	CUL	Collaboration	
135	Skilled communication	CON	Communication	
136	Quick problem solving	JD	Quick problem solving	
137	Accessible & fair leader	LP	Support from supervisor and co-workers	
138	Positive & social climate	CUL	Healthy workforce	
139	Reasonable work load	JD	Working hours	
140	Work content	JD	Job content	
141	Safe physical work	JD	Safe working environment	
142	Appropriate staffing	LP	Leadership	
143	Adm./personal support	LP	Support from supervisor and co-workers	
144	Working time schedule	JD	Working hours	
145	Work-life balance	CUL	Work-life balance	
146	Relations to stakeholders	LP	Leadership	
147	Benefit to society	POL	Healthy workforce	

Cleaning

The condensed 142 names were consequently analysed as well, and it was noticed to have multiple duplicates. This is a result of different authors' presentation of same measure. As such, all the duplicates in the 142 were deleted and 46 remained as the total set of indicators necessary to measure health and well-being in the workplace. At this stage, a few redundant items also had to be eliminated. For instance, item #86 and #87 from the publication of Lowe and Chan (2010a) which addressed the issues such as patient satisfaction and patient-perceived quality of healthcare were both eliminated as they were quite specific to a hospital patient's physiological health which doesn't seem to be of any relevance in our research.

Categorization

The final step of this analysis involved putting these 46 indicators into categories. For the categorization process, the 46 condensed indicators were further assessed based on their context, what measure it will be evaluating and its significance to a specific requirement of workers' health and well-being. The analysis at the condensation stage led to the derivation of the final set of 19 KPIs with their corresponding Sub-indicators as outlined in table 24.

Table 24: KPI Categorization Table

#	INDICATORS	SUB-INDICATORS
1	**Availability of Acoustic Comfort measures**	
		Acoustic Control via space planning Construction methods for acoustic control
2	**Adequate Luminance**	
		Adequate Luminance Levels for Tasks Appropriate Technology for Visual Comfort
3	**Glare Control Mechanism**	
		Limited Glare
4	**Availability of Natural Ventilation**	
		Adequate Natural Ventilation
5	**Air Quality Control Measures**	
		Usage of zero-emission finishes /VOC control Appropriate Design Technology for maintaining adequate Air Quality Absence of conditions for Mould Growth
6	**Thermal Comfort Measures**	
		Design Provision of Thermal Control Means of Regulating Thermal Control
7	**Space Layout and Ergonomic Furnishing Comfort**	
		Workstation Ergonomic Design Comfort Flexibility and Provision of Social Spaces

#	INDICATORS	SUB-INDICATORS
8	**Biophilic Design Comfort**	
		Feel of Nature
9	**Leadership Role Clarity and Expectation**	
		Leadership
		Role clarity
10	**Psychosocial Support**	
		Supportive supervisor
		Cooperation among workers
		Quick problem solving
		Support from supervisor and coworkers
		Communication
11	**Workload Management**	
		Working hours
		Workload management
12	**Positive Social Climate**	
		Worker retention
		Job satisfaction
		Work-life balance
		Flexible working
13	**Civility and Respect**	
		Respectful and trusting relationship
		Treated with respect
		Workplace violence
14	**Recognition and Reward**	
		Recognition & feedback
		Recognition & reward
		Reward Strategies
15	**Organizational Culture**	
		Culture
		Fair processes
		Collaboration
16	**Job Content**	
		Job content
17	**Safe Working Environment**	
		Safe working environment
		Healthy workforce
		Worker safety
18	**Growth and Development**	
		Growth & Development
		Workers growth and development
		Workers Development
19	**Engagement, Influence and Involvement**	
		Participation in decision-making
		Organizational influence
		Influence & involvement

Duplicates and similar indicators eliminated after cleaning

Table 25 gives a list of how the first set of 142 indicators have been clustered into the final categories of 19 indicators. This itemises every singular indicator from literature and what they have become after the entire analysis. Also attached are the numbers of the redundant indicators that were identified as irrelevant to our research objective.

Table 25: List of Merged Indicators after cleaning

#	Indicators	Num. of Merged Indicators
1	Availability of Acoustic Comfort measures	78, 57, 56, 24, 23, 22, 4, 2, 1, 79, 58, 39, 21, 3
2	Adequate Luminance	77, 76, 55, 54, 16, 15, 14, 51, 38, 52, 29, 19, 18
3	Glare Control Mechanism	53, 20, 17
4	Availability of Natural Ventilation	73, 43, 5
5	Air Quality Control Measures	73, 42, 40, 32, 30, 10, 72, 41, 37, 11, 9, 8, 7, 6, 70, 44
6	Thermal Comfort Measures	48, 47, 46, 45, 36, 13, 75, 50, 49, 12
7	Space Layout and Ergonomic Furnishing Comfort	65, 60, 59, 35, 33, 27, 61, 34, 26, 25
8	Biophilic Design Comfort	64, 63, 28
9	Leadership Role Clarity and Expectation	80, 83, 108, 116, 129, 142, 146
10	Psychosocial Support	98, 99, 136, 137, 135, 143
11	Workload Management	118, 121, 144
12	Positive Social Climate	88, 89, 92, 93, 126, 127, 145
13	Civility and Respect	97, 122, 123, 125
14	Recognition and Reward	102, 119, 124, 130
15	Organizational Culture	84, 101, 103, 134
16	Job Content	105, 106, 107, 139, 140
17	Safe Working Environment	94, 100, 110, 111, 120, 138, 141, 147
18	Growth and Development	104, 109, 131, 132
19	Engagement, Influence and Involvement	82, 91, 95, 115, 133
	Redundant Indicators	31, 66, 67, 68, 69, 74, 85, 86, 87, 90

The final list of KPI

The objective of this dissertation was to build up a list of key performance indicators which this chapter serves as a starting point. Listed in table 26 are the descriptions of the final set of KPIs together with the possible metrics that can be used to measure them subjectively. However, from our review of several works of literature, it's been discovered that performance indicators have to be validated in order for it to be considered for implementation. Thus, these indicators will be subject to further examination with experts to discuss and analyse their views on its applicability in a real work environment.

Table 26: Final List of KPI with description and Metrics

#	KPI	Description	Possible Metrics	Source
1	**Adequate Luminance**	Luminance in the workplace represents the adequate amount of light that impinges upon, emitted from or is reflected from the workstation of the worker as such avoids occupant from eyesight problems.	Presence of Optimum Natural Lighting for tasks Adequate artificial luminaire Uniform illuminance on task area The ratio of the minimum illuminance to the average illuminance on the background area Uniform illuminance on immediate surrounding area Appropriate Technology for Visual Comfort	(Loomans, 2011; Elzeyadi, 2017; Al horr *et al.*, 2016)
2	**Air Quality Control Measures**	Air Quality control measures refer to the techniques employed to reduce or eliminate the emission into the workspace, substances that can harm the occupant's health	Usage of zero-emission finishes /VOC control What is the quality of the indoor air delivered through mechanical ventilation? Presence of man-made vitreous fibres, tobacco smoke, particulate matter. Appropriate Design Technology for maintaining purifying ventilated air. Absence of conditions for Mould Growth Does the system provide sufficient ventilation How effective is the system in delivering air to each space	(Desmyter and Huovila, 2010; Alker *et al.*, 2014a; Devitofrancesco *et al.*, 2019)
3	**Availability of Acoustic Comfort measures**	Acoustic comfort refers to the state where an occupant classifies the space as sound and void of noise that induces stress reactions and a decreased sense of general well-being. Occupants are affected by the levels and nature of sound experienced.	Average noise interruption from colleagues Noise from Mechanical plants (Winter/summer air-conditioning) Sound Reverberation in workplaces Grouping similar types of areas together Sound masking systems in open offices Policy in place addressing proper workplace etiquette WP to promote courteous behaviours related to generating unwanted noises for other people surrounding Construction methods for acoustic control Presence of Phone booths and concentration rooms Occupant satisfaction with level of sound privacy	World Green Building Report Lee & Aletta

#	KPI	Description	Possible Metrics	Source
4	**Availability of Natural Ventilation**	Refers to the process of moving outdoor air into a building naturally through windows or doors, and distributes the air within the workspace. The warm and dirty air inside of the building is forced out through the opening in the roof. Achieved through wind-based or buoyancy-driven ventilation.	How effective is natural ventilation Natural Ventilation times in the year Occupants comfortability in natural ventilation Is there a need for mechanical plants to aid in Natural ventilation	(Abbaszadeh *et al.*, 2006; Shafaghat *et al.*, 2014)
5	**Biophilic Design Comfort**	The biophilic design stands for the concept of designing to increase occupant connectivity to the natural environment by the use of direct nature, indirect nature, and space and place conditions.	Presence of greenery in workplace Occupant satisfaction with look and feel of Occupant Proximity to window Presence of scenic views from windows	(Abbaszadeh *et al.*, 2006; Esfandiari, Zaid and Azzam Ismail, 2017; Elzeyadi, 2017)
6	**Civility and Respect**	This depicts a work environment where employees are respectful and considerate in their interactions with one another, as well as with customers, clients and the public.	Is aggressiveness rare among you and your co-workers? Are you exposed to conflicting demands from others? Is the atmosphere in the workplace good?	(Karasek et al., 1998; Fingerhut et al., 2010)
7	**Engagement, Influence and Involvement**	This describes a workplace where workers are included in discussions about how their work is done and how important decisions are made.	Do you have a large degree of influence concerning your work? Do you have enough freedom to decide how you want to do your job? Do you have much say about what happens in the workplace?	(Kristensen et al., 2005; Grawitch et al., 2009; J., 2014; Schütte et al., 2014)
8	**Glare Control Mechanism**	Glare refers to the difficulty of seeing in the presence of a bright light which may be caused as a reflection of a bright source of light. Glare at workstations may be caused by either artificial or natural sources or light.	Occupant discomfort glare from natural lighting Daylighting discomfort glare in the immediate surrounding area Discomfort glare due to artificial lighting Spectral reflectivity of worksurfaces Can occupant relocate in the case of Glare Amount of hours in day where Glare is experienced	(Chwalbińska-, Kusek and Olszewska, 2015; Elzeyadi, 2017)
9	**Growth and Development**	This represents a workplace where workers receive encouragement and support in the development of their interpersonal, emotional and job skills.	Do you have the possibility of learning new things through your work? Do you try to find out what you can do to solve a problem? Do your job require you to assimilate new knowledge? Do your job require you to be creative? Do you have the opportunity to develop new skills?	(Karasek et al., 1998; Lindberg and Vingård, 2012; Raziq and Maulabakhsh, 2015)

#	KPI	Description	Possible Metrics	Source
10	**Job Content**	This describes a workplace where there is recognition of the need for balance between the demands of work, family and personal life.	Does your job require you to work very quickly? Does your job require you to work very hard? Does your work include some repetitive tasks? Does your work include many activities? Does your work require that you remember a lot of things?	(Karasek, 1979; Karasek et al., 1998; Chiu et al., 2009)
11	**Leadership, Role Clarity and Expectation**	This describes how effective leadership support help workers know what they need to do, how their work contributes to the organization and whether there are impending changes.	Do your superiors serve as role models? Are contradictory demands placed on you at work? Are you informed in advanced about important decisions, changes or plans for the future? To what extent would you say that your superior is good at work planning?	(Karasek et al., 1998; Della et al., 2008; Milner et al., 2015)
12	**Organizational Culture**	This describes the patterns an organization has developed to cope with issues related to its internal integration and external adaptation characterized by trust, honesty, fairness and collaboration among workers.	Do you enjoy telling others about your workplace? Do you have a clearly outlined wellness policy at work? How well has your desired culture been internalised & understood? Is your organizational culture a daily practice? How do new employees describe the culture?	(Secker and Membrey, 2003; Kristensen et al., 2005; Mellner, 2016; Von der Heyde, 2018)
13	**Positive Social Climate**	This describes a work environment where there is a good fit between employees' interpersonal and emotional competencies and the requirements of the position they hold.	Is your work emotionally demanding? Does your work require that you hide your feelings? Can you decide when to take a break? How pleased are you with the people you work with?	(Kristensen and Borg, 2003; Lowe and Chan, 2015; Raziq and Maulabakhsh, 2015; L., O. and K., 2018)
14	**Psychosocial Support**	This implies creating an atmosphere where co-workers and supervisors are supportive of workers' psychological and mental health concerns, and respond appropriately as needed.	How often do you get help and support from your colleagues? Is the atmosphere in the workplace good? How often does your superior talk with you about how well you carry out your job?	(Pelfrene et al., 2002; Kristensen and Borg, 2003; Schütte et al., 2014)
15	**Recognition and Reward**	This represents a workplace where there is appropriate acknowledgement and appreciation of workers' efforts in a fair and timely manner.	Are you being recognised by management? Is your salary fair in relation to your effort at work?	(Dellve, Skagert and Vilhelmsson, 2007; Pejtersen et al., 2010)

#	KPI	Description	Possible Metrics	Source
16	**Safe Working Environment**	This describes a work environment where management takes appropriate action to protect the physical safety of employees.	Is there a shift or location that is most prone to incidents? Does an employee's time with the company have an impact on their likelihood to become involved in incidents? What are the most often occurring types of employee injuries?	(Komisjon, 2017; Five Key Safety Metrics to Improve Performance -- Occupational Health & Safety, 2018; Garrod et al., 2018)
17	**Space Layout and Ergonomic Furnishing Comfort**	Space layout in the workplace context refers to the method an organization has arranged the workplace for ease of movement and zoning of areas to support activities. Additionally the kind of furnishings at the workplace are under this section.	Occupant satisfaction with furnishing How adaptable is the space to occupant Occupant's satisfaction with comfort of office furniture Does layout facilitate peer-to-peer communication Number of ways furniture can be adjusted to meet needs of the user Occupant satisfaction with ease of interaction Knowledge sharing capabilities Occupant satisfaction with visual privacy Total amount of space allocated to each member for work Presence of task based spaces that encourage standing Flexibility and Provision of Social Spaces	(Desmyter and Huovila, 2010; Alker *et al.*, 2014a; Devitofrancesco *et al.*, 2019)
18	**Thermal Comfort Measures**	Thermal comfort is the condition of mind that expresses satisfaction with the thermal environment of an occupant and is assessed by subjective evaluation	Design Provision of Thermal Control Air temperature and Air cooling with mechanical cooling What is the Predicted mean reading during summer. Air Velocity and Draught Risk What is the Predicted mean reading during winter. Air Temperature and air humidity levels Means of Regulating Thermal Controls	(Esfandiari, Zaid and Azzam Ismail, 2017; Richardson *et al.*, 2017)
19	**Workload Management**	This explains how tasks and responsibilities can be accomplished successfully within the time available.	Do you have enough time to finish your work? Are you required to do excessive work? Do your work include many activities?	(Karasek et al., 1998; Janssen and Nachreiner, 2004; Cheng et al., 2012)

Conclusion on KPI Selection

After a detailed description of performance indicators and the need for performance management, a systematic review was conducted for the development of performance indicators necessary for assessing the impacts of NWW on health and well-being of workers begun. A final list of 147 performance indicators was realised from this review. To further cut down this list, a content analysis was performed resulting in 19 KPIs. These KPIs will be validated through an assessment within a company in the next chapter.

CHAPTER 6 - VALIDATION OF KPI IN AN ORGANIZATION

This chapter is devoted to reviewing the KPIs, validating and evaluating them in a real-world setting. The chapter is divided into four distinct sections. Section 6.1 is an introduction of the selected workplace, then proceeded with the actual sector of the company being deliberated upon (section 6.2). The KPI is ranked and validated in section 6.3. Section 6.4 and 6.5 comprises of the author's remarks and recommendation respectively. As represented in the sketch below.

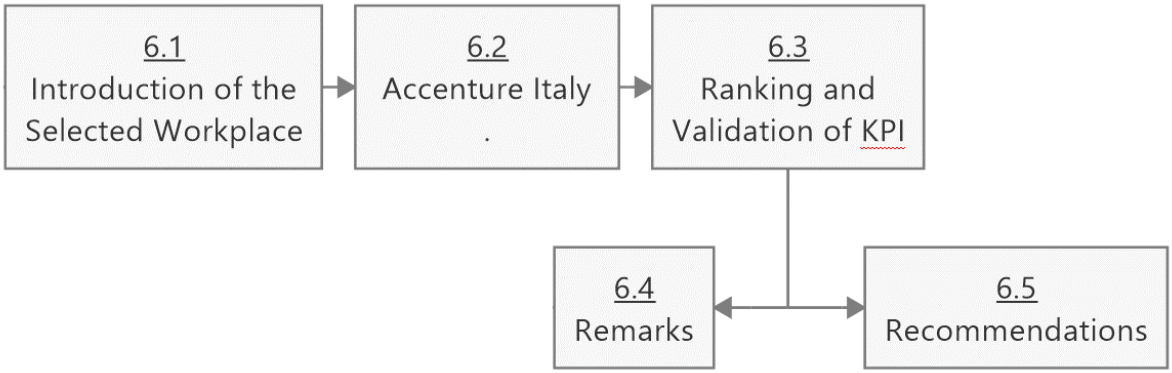

Figure 12: Structure of Chapter 6

6.1 INTRODUCTION OF THE SELECTED WORKPLACE

The company chosen to prioritize and confirm the validity of these set of KPIs as being able to measure and assess the health and well-being of workers is **Accenture Italy**. This choice was informed based on several considerations listed below in no particular order.

- A global company with branches operating all around the world since the impacts of NWW is largely influenced by the work culture of countries.
- A company whose employees have experience in a variety of industries in key business areas as well as a diverse client base.
- A company that has already started practising these new ways of working with proven results of its credibility through international recognitions.
- A company that prides itself on being people-focused by enabling an environment that fosters a collaborative and supportive lifestyle.

6.1.1 Company Profile

Accenture is a leading global professional services company established in 1989. Accenture provides a broad range of services and solutions: strategy, consulting, digital, technology and operations. Leveraging its deep expertise across industries and business functions, Accenture helps organizations

shape their vision for the future by driving innovation to develop and implement differentiated solutions that accelerate growth and increase efficiency and may run parts of clients' businesses on their behalf. Ultimately, Accenture aims to enable clients to maximize their performance and create sustainable value for their stakeholders. Accenture has consequently received several international "recognition as a great employer" over the years for its various programmes to foster work-life balance for its employees. A brief overview of the company as in the final quarter of 2019 is as follows.

Employees:	492,000 (7,400 Accenture Leaders)
Global reach:	Offices and Operations in 200+ cities in 51 countries
Geographical region:	North America, Europe, and Growth Markets
Industry Expertise:	Accenture delivers its services and solutions through 13 focused industry groups in 5 operating groups: Communication, media & technology, Financial services, Health & public service, Products and Resources. These industries focus provides Accenture's professionals with a thorough understanding of industry evolution, business issues and applicable technologies, enabling us to deliver innovative solutions tailored to each client.
Clients:	Accenture operate at the heart of our clients' businesses, helping address their most complex, mission-critical issues. Accenture's clients span the full range of industries around the world and include 91 of the Fortune Global 100 and more than three-quarters of the Fortune Global 500.
Core Values:	Accenture values shape the culture of the organization and define the character of the company. The core values are lived through individual behaviours and serve as the foundation for how they act and make decisions. The core values are: Client value creation; One global network; Respect for the individual; Best people; Integrity; Stewardship.

6.1.2 Organizational Work Environment

The work environments of Accenture use the latest technology and tools to support a healthy and productive work experience. A typical Accenture workplace is expected to:

- Emphasize team-based activities
- Encourage relationship building, knowledge sharing and acculturation
- Address new generations of workers who have different workplace expectations and requirements

- Leverage new technologies to support the increasingly mobile and distributed nature of our work
- Lower carbon footprint through digital communication and collaboration

Accenture employees can work in different work environments as a result of its diverse client base. For example, an employee alongside his/her project team can work at a client site as part of a customer service team of a delivery centre or telecommuting from your home or other locations or hoteling at the local Accenture office. Whether working virtually or onsite, Accenture provides multi-functional spaces that support innovation, creativity, teamwork, learning and development.

Physical Office*:* Accenture designs its workplace to provide employees with flexible work areas that enhances networking, knowledge-sharing and collaboration so as to improve employee productivity and well-being. The offices are designed with these specific guidelines provided by top management: Space planning, Comfortable and convenient work environments which are physically accessible for all as well as basic and advanced service facilities. Accenture's diverse types of spaces include Training corporate schools, Business Process Outsourcing (BPO) delivery centres and Digital workplaces comprising of innovation hubs, liquid studios, and digital studios/hubs. A typical Accenture office building usually houses various spaces dedicated to:

- Open-office spaces where employees take phone calls and join an online conference
- Meeting rooms suited to various scenarios, with different layouts and sizes
- Coffee-shops, where baristas serve delicious freshly brewed coffee
- Phone-booths for private conversations
- Dedicated work-free zone featuring plants, cosy sofas and soothing sounds
- Complimentary services that would motivate employees to come to the office and be able to work without any disruptions

Flexible schedule options*:* Accenture provides innovative communication and collaborative tools that help employees stay connected globally and offers several voluntary flexible options for how, and where, you do your work in order to balance employee work and personal life. Details of some flexible work arrangements Accenture offers are as follows:

Flextime schedule: This allows employees to vary their start and finish times around predetermined core hours, or work their standard hours in fewer than five days by varying the length of each workday.

Part-time arrangement: This enables employees to work less than a standard full-time weekly schedule, by working fewer hours per day or fewer days per week. Usually, the role is designed around a reduced workload so that job responsibilities match the number of hours worked.

Job-sharing arrangement: This involves dividing the workload of a full-time position between two employees (usually each working a part-time schedule). It's a great way for our people to keep on the career track while allowing them more time outside of work.

Telecommuting/home working: This enables employees to work from a location other than an Accenture office or project site. This can reduce the time, costs and stress of commuting for employees while helping Accenture control and often reduce the cost of fixed office space.

Client-site flexibility: This manages employees time away from home with fly-back flights, compressed workweeks, extended weekends and time at the client.

6.1.3 Comparative Analysis of NWW practices

These illustrations of the flexible working arrangements offered by Accenture shares similarities with the non-exhaustive list of NWW practices by Moll, (2015) presented in Table 1. Comparing both at first glance, the names given to each practice appear slightly different, but they share synonymous descriptions. The table 27 below presents a comparison of names as given by both.

Table 27: Similarities in NWW Practices between Moll (2015) and Accenture.

NWW Practices by Moll, (2015)	NWW Practices by Accenture
Teleworking	Homeworking
Mobile working	Telecommuting
Flexible workspaces	Physical offices
Flexible working hours	Flexitime schedule

Accenture clearly states that employees in smart working can choose the best location to perform their job and are not mandated to only work from home. This also agrees with Moll, (2015) description of satellite offices.

As part of the NWW practices listed by Moll, (2015), Freedom in Choice of Tools and ICT Support - Communication Tools are related to the digital tools that employees choose to enable them stay digitally connected and collaborate. In the same way, Accenture work environments also boast of using the latest technology and tools to support a healthy and productive work experience. They provide innovative communication and collaboration tools to help increase productivity, efficiency and flexibility to keep their employees connected globally.

Accenture also offers part-time arrangement and Job-sharing arrangement which are different from the conventional ones. With this, emphasize is laid on workload management where they try to make sure that the workload is commensurate with the job responsibilities of the employee to enable them keep on the career track while allowing them more time outside of work.

However, Accenture offers some flexible work arrangements that wasn't covered by Moll, (2015). These are peculiar to the company as they were designed to help consulting professionals who spend much of their time working at client sites away from their home location. These are defined under client-site flexibility and they include:

Fly-back program: This program help support work/life balance for employees with significant travel, often the case for consulting professionals. They are offered fly-backs to their home location, the option to fly someone to their project site, and the option to fly to an alternate location in place of a trip home.

Full weekend at home: This allows the professional to arrive at the project midday on Monday and stop client work early Friday afternoon, thereby providing for a full weekend at home. Work the same number of hours as a full work week, but compress the work into a shorter time frame.

Extended weekends in home location: This involves working a five-day work week, four days at the project site and the fifth day in the home office or approved alternate location, with either three or four nights at the out-of-town location.

Extended client/home location: This implies working an extended period of time at a client site followed by an extended number of days at the home office or approved alternate location, without altering the standard work week requirement and changing only the time of the hours worked.

All of the flexible working arrangements peculiar to Accenture help address the challenges that come with the professional travel experienced by many of their consulting employees. This goes to show that different companies can design arrangements that are better suited to meet the specific type of employees they have.

6.2 ACCENTURE IN ITALY

Accenture branch in Italy currently has over 14, 000 employees. The company has main offices in Milan, Rome, Turin, Naples and Cagliari, as well as several offices throughout the country. Italy is an integral part of Accenture's international network with 5 innovation centres and 2 delivery centres. Its offices in Italy have been designed to meet all the requirements outlined above. In Italy, Accenture was the first company to activate smart working as a complementary modality to the traditional

presence in the office year 2009, offering some of the flexible work arrangements listed above, albeit, it is not yet available for all its employees.

6.2.1 Accenture Italy Present State Analysis

An interview was conducted by the authors of this research study with a team of HR experts (having over 20 years' experience) from Accenture whose responsibility is solely for employees engaged in smart working. The choice of these experts is justified by the aim this research hopes to achieve, i.e., to assist companies engaged in NWW assess its impact on the health and well-being of its employees. This section presents the current state of Accenture, Italy in the implementation of the smart working programme as provided from the interview conducted (See Appendix 1 for interview questions).

These experts gave a definition of a healthy workplace as "a workplace that satisfies the requirements of Law N. 81/2017". This is the new Italian labour and employment legislation which came into effect in June 2017. This law "Lavoro Agile" (Smart working) makes provision for the protection of workers engaged in the new flexible working arrangements (see Appendix 2).

Accenture Italy currently has 3,500 'official' smart workers out of their over 13, 000 employees. The term 'official' means that these employees must have signed an individual smart working agreement as requested by law and have notified the ministry of labour in the event of accidents. This is a voluntary decision taken by the employees allowing them to work 2 days per week outside of the company location. The employees also have to complete mandatory one-hour training on the rules of smart working as concerns health and safety, the requirements of IEQ, ergonomics and break time and then sign a health and safety agreement. After which, they will have to sign additional agreement on related to the company policy on Privacy, Storage of data, and Secure connection. These employees are charged with the responsibilities to ensure that their choice of location outside company premises is safe and to follow same health and safety rules applicable in the office space (For example, ensure to take breaks in between work).

Accenture Italy currently has no innovative tools (Such as wearable sensors or smart applications) specifically dedicated to gathering information on the health of their workforce. They also do not provide any ergonomic equipment or fee for that purpose since employees are not mandated to work from home but rather, any convenient and safe location of choice close to home (For example, a co-working space).

Accenture Italy recently conducted a pilot study 9 months ago to assess the impact of smart working as a company. This study was launched with 3 surveys described below:

Survey 1: The respondents were the official smart workers, i.e., employees who are already engaged in smart working. They were asked about the benefits and to give an overall evaluation of the smart working programme.

Survey 2: The respondents were supervisors. They were asked for an overall evaluation of the programme but also giving particular attention to any issues or technical challenges faced.

Survey 3: The respondents were employees who even though granted the request for smart working, didn't take any action and why they didn't? Is their decision related to other issues (For example, "My supervisor is not the right role model because he's always in the office" or "No location close to me"?

The results of this survey present positive feedbacks and it is a good confirmation for the continuation of the smart working programme as it reported the following results:

- Happier employees
- More focused employees
- Reduced commuting time especially for employees living outside of Milan
- Supervisors reported no main issues in maintaining performance but rather, there was a subjective increase in productivity
- Increase in employee motivation and engagement

6.3 RANKING AND VALIDATION OF KPIs

In lieu of the above discoveries made, Accenture represented the most capable organization to aid in the validation and ranking of our KPIs. Early on, five pertinent steps were identified as the prerequisite to establishing actionable performance indicators. They were 1) Establishing of Organizational Goals and Objectives 2) Establishing CSF from Goals and Objectives 3) Establishing KPIs 4) Collect measures and 5) Calculate and Evaluate Metrics. During the review of relevant literature, the first three steps were generated through the evaluation of multiple sources of indicators and industry/s best practices for organizational goals and CSFs. The process resulted in 19 most relevant KPIs paramount to the health and well-being of the worker. Stages 4 and 5 which is being described in this section were achieved through a series of interviews with Accenture.

6.3.1 Interview

The approach to this section of the research was conducted in three different stages. As explained below,

a) The first was a fact-finding interview with the managing director. This part of the work was dedicated to making enquiries about the existence of a smart working program,

his general opinion and a brief overview of how the company has benefited from this approach to work. Upon determining the existence of these new ways of working, a second interview was required for further elaboration from the program planners.

b) The two main Smart Working program planners were interviewed next. This team of planners included a Human Resource Manager and the manager designated for assessing the smart working program. All major questions were answered within this interview and along the way it was established that no singular specific survey as of the moment of the interview was in place for measuring health and wellbeing in the smart workplace context but rather overlapping different surveys conducted in house factored in majority of the KPIs identified.

c) The last interview ensued between the researchers and the manager designated to the smart working only. It was a follow up to ask for a few clarifications, relay findings and give suggestions after the previous interview results were analysed.

Table 28: Profile of Interviewees

Interviewee Demographics			
1st meeting		Top Management	
2nd meeting		HR & HR designated to smart working	
3rd meeting		HR designated to smart working	
	Rank in Company	Department	No of Years in Company
Expert A	Managing Director	Executive	22
Expert B	Manager	Human Resource Management	22 & 13
Expert C	Manager	Smart Working Program Manager	13

The series of interviews just described progressed to the need for an AHP as described next.

6.3.2 An Analytical Hierarchical Process for Ranking KPI

During the interview, the research team asked interviewees first of all to give a general overview of the KPIs selected. They reiterated the relevance of all the selected ones. Sequential questions about the measurement metrics were reviewed. This was further confirmed as they acknowledged that a number of the possible metrics already listed in the questionnaire were part of those evaluated in their most recent survey on the impacts of smart working. Reliant upon the company in-house data, a further enquiry was made to help score the KPIs. Inferences were made on the scores gathered and

subsequently, those results were used as data for an Analytical Hierarchy Process developed by Thomas L. Saaty in 1980. The AHP was used for the prioritization of the KPIs by performing the following steps:

Step 1) Definition of problem: This stage corresponds to the selection and listing of all the key performance indicators. After the entire selection procedure described earlier in section 5.4, the resultant set of KPIs are thus inserted in the matrix (See appendix 3 for details).

Step 2) Development of the hierarchy model: Build the AHP relying upon the experts' recommendation on the level of impact these KPIs will have in the assessment of the health and well-being of employees. A nine-level hierarchy of scores as shown in table 29 served as a guide in scoring.

Table 29: Scoring Approach

Intensity of Values	Interpretation
1	Indicators i and j are of equal value
3	Indicator i has a slightly higher value than j
5	Indicator i has a strongly higher value than j
7	Indicator i has a very strongly higher value than j
9	Indicator i has an absolutely higher value than j
2, 4, 6, 8	The intermediate scales placed between adjacent judgements
Reciprocals	If requirement i has a lower value than j

Where 'i' represents the vertical indicators and 'j' the horizontal.

Step 3: Perform a pairwise comparison: Comparisons were made between two individual indicators and their allocated scores inserted on the matrix. Each indicator was thus paired against all the other nineteen indicators (See Appendix 3 for details).

Step 4: Synthesize the Pairwise Comparison: Here, the vectors of priorities are calculated for each indicator. The average of normalized column (ANC) is used. In ANC the elements of each column are divided by the sum of the column and then the elements in each resulting row are added. This sum is subsequently divided by the number of elements in the row (Check Appendix 4 for total breakdown). The outcome yields a priority vector for each indicator.

Step 5: Prioritize the KPIs: According to the priority vectors derived which serve as a representation of their relevancy, the KPIs are thus ranked as shown in table 30 below. The KPI with the largest vector score is ranked highest and this ranking follows to the least vector score being ranked as the lowest.

6.3.3 Results

In figure 13 below, the results of the AHP process is represented in a hierarchical manner from the most prioritised KPI to the least prioritised KPI associated to the workplace health.

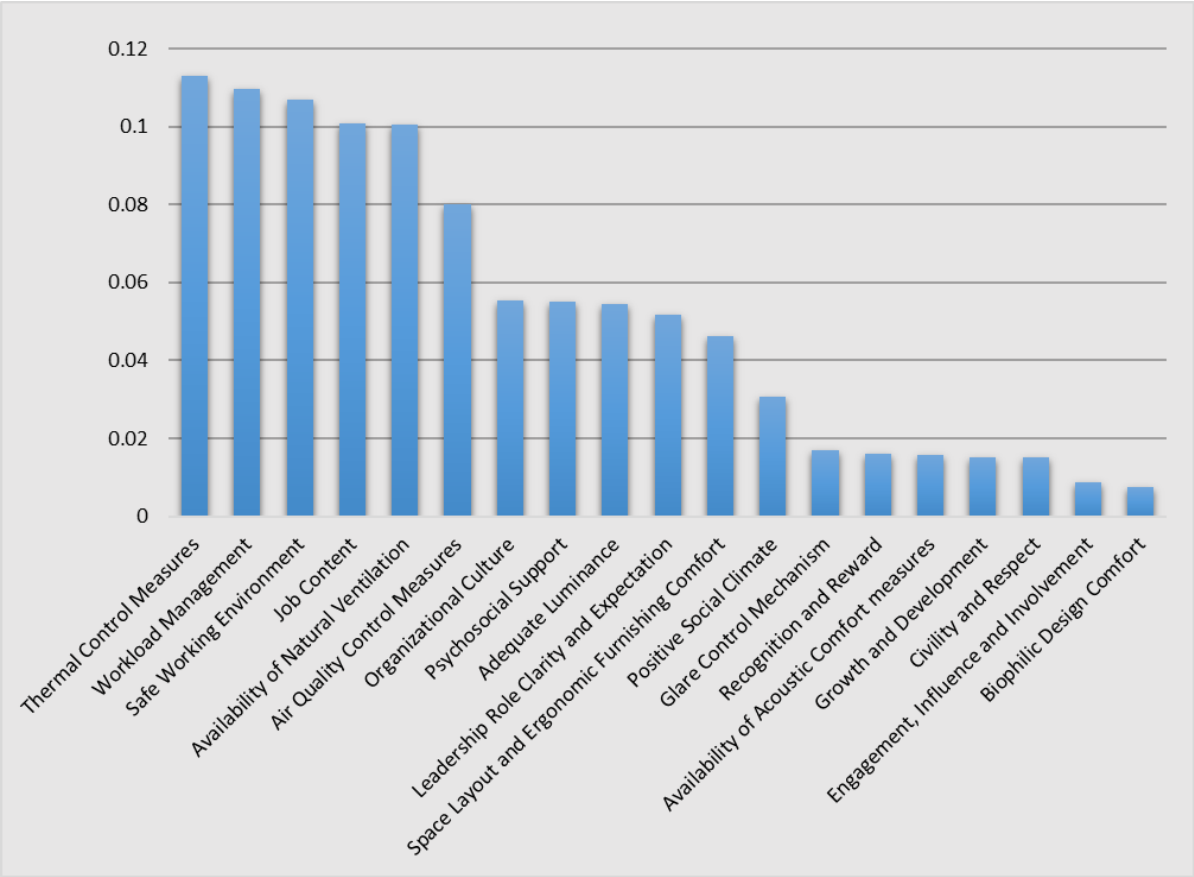

Figure 13: Analytical Hierarchical Process results on KPI

Figure 13 above prioritises 'Thermal Control Measures' as the most relevant KPI and the 'Biophilic Design Comfort' as the least relevant KPI where worker health and well-being are concerned. As described by Esfandiari, Zaid and Azzam Ismail (2017), thermal control measures stand for all the control measures that ensure the thermal comfort of an occupant. This unequivocally stood out as first because an office setting which is too cold or exceedingly warm is uncomfortable either way and that serves as a trigger to several other parameters. The 'Biophilic design comfort' was considered as the least relevant factor. This could be associated with the fact that workspaces are now starting to adapt factors such as the presence of greenery into their design. Although relevant, it has not been in existence for long so as to make the general work population aware of all of its benefits.

'Workload management', 'Safe Work Environment' and 'Job Content' all attributed to psychosocial work factors proceeded after the Thermal Control Measures. These factors as described by Karasek, (1998) address the core generators of mental stress in the workplace. Silverstein (2008) additionally describes a safe work environment as one void of any form of injury. These three factors are quite dominant on the mental stress of a knowledge worker and quite warrant their position.

Table 30 below shows the final ranking of the set of KPIs. This actually connotes to the general overview given by the experts before the AHP ranking. As such these KPIs are deemed valid and their ranking actively represents what majority of workers in a smart workplace would consider necessary to their health and well-being.

Table 30: Final List of KPI ranked according to employee health priority

Indicators	Rank	Priority
Thermal Control Measures	1	High
Workload Management	2	
Safe Working Environment	3	
Job Content	4	
Availability of Natural Ventilation	5	
Air Quality Control Measures	6	
Organizational Culture	7	
Psychosocial Support	8	
Adequate Luminance	9	
Leadership Role Clarity and Expectation	10	
Space Layout and Ergonomic Furnishing Comfort	11	
Positive Social Climate	12	
Glare Control Mechanism	13	
Recognition and Reward	14	
Availability of Acoustic Comfort measures	15	
Growth and Development	16	
Civility and Respect	17	
Engagement, Influence and Involvement	18	
Biophilic Design Comfort	19	Low

6.4 REMARKS

Workplace management encompasses diverse roles and as stated earlier, KPIs are better tracked if individual 'responsible person' are attached to each. Figure 14 below establishes the significant sectors related to stakeholders. The eleven indicators associated with the people can better serve an organisation if their attainment is associated with both the business and human resource

management teams. Concurrently, the set of nine KPIs associated with the space is better associated with facility management, the design and workspace planning teams.

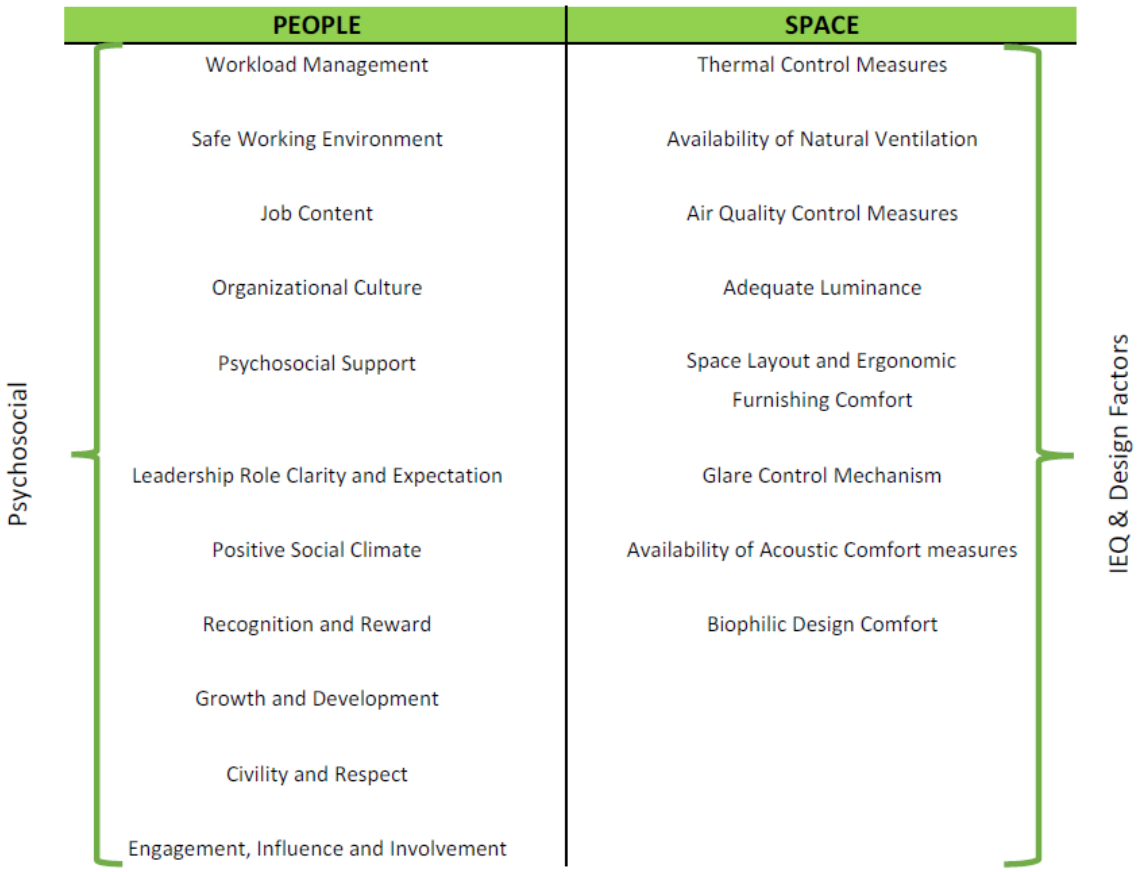

Figure 14: KPI relationships

In table 26 above, a set of possible metrics were identified to help make KPIs actionable and easy to track or measure. For better optimization of these KPIs, the following can be applied

- The KPIs associated with the people were found as having a keen familiarity with the psychosocial factors identified in section 3.3.3. Thus, measures like having enough time to finish works, salary correlation to workload, getting of support from colleagues and superiors and works being emotionally demanding are just a few of the metrics that can be implemented. The higher the frequency of surveys, the more reliant KPIs can be reviewed and readapted.
- For the selection of KPIs dedicated to space, scientific instruments should be applied in the cases where the metrics are not subjective. The relevance of this is to ascertain how the work

environment is faring at the post-occupancy stage as against the designing phase. Frequency is still relevant here as well.

6.4.2 Guidelines for Implementation

The usefulness of KPI lies in its ability to measure what it was proposed to measure. This is necessary so as to attain expected results and provoke appropriate behaviour both from the employer and employees. Therefore, in order to achieve this, a guideline that can be used for operational purposes need to be prepared. This will serve as an operative instrument that potential workplace managers seeking to delve more into the health and well-being sector of the workplace can adapt to implement the above set of KPIs. This guideline comes in the form of a card dedicated to one specific KPI which contains the most significant properties of each KPI. In drafting this card, it is important to keep in mind what exactly is being measured, why it is being measured and how to measure it. The answers to these questions will be the contents of this card. The descriptions below give details on what each property signifies after which an example is provided for the highest ranked KPI, 'Thermal comfort measures.'

Purpose

This gives a brief reason why the KPI is being implemented. It clearly states the aim the measurement will achieve in the accordance with the strategic goal of the company as it concerns employee health and well-being. This helps relevant stakeholders to assess the usefulness of the KPI in order to decide on how to improve on it if needs be.

Responsible Person

This simply refers to the person who has the best experience, skill, and knowledge to lead the interpretation of and response to the measure. This person has access to the data, knowledge of how that sector works and is in a position to make decisions about how to improve the sector.

Applicable Standard

This element on the card refers to all relevant guidelines or codes of practice issued by a governing body having jurisdiction to issue such standards. They usually contain the globally or nationally acceptable specific measurements or rules which the particular KPI must conform to.

Frequency of measurement

This explains how frequency the KPI should be measured. This depends on the characteristics of the particular KPI, such as, how often it's related information changes or is collected. It also depends on the value placed on the KPI for decision-making.

Source of data

This is dependent on the assessment being carried out. For subjective assessment that require quantitative measures, data can be obtained via measuring instruments while for objective assessment, data can be obtained through surveys by means of questionnaire.

Measurement Metrics

This is the sector which contains all the dimensions that needs measurement to signify the KPI. First off, the dimension should be sufficiently detailed, clear and unambiguous. The responsible person as well as affected workers should have some training prior to measurement especially when measuring aids and instruments are involved. Every other additional input on the measurement method is provided in this section.

Units of Measurement

KPIs related to the space and in particular the indoor environment quality that require standardized measurement need to be recorded in the correct unit of measure for easy and accurate analysis and reporting.

Benchmark Scale

The various dimensions of measurement that contribute to form a KPI are usually measured in several other units. In order to have a common measurement criterion, the different measuring units should be converted into percentages that would aid in a fair assessment. The benchmark as shown in figure 15 below shows the exact range a KPI would fall after measurement and what that signifies.

Indicator Value

This last element stands for the average value derived after all the measurement. This is then assessed against the value shown on the benchmark scales to determine whether the organization is performing at its best or deficient in a way when it comes to that KPI and needs to adapt a new strategy to elevate that aspect.

INDICATOR CARD			
Indicator Name:	**THERMAL COMFORT**	AFFILIATION:	**SPACE**

PURPOSE
To check the satisfaction of occupants in the workplace with respect to the thermal environment of an occupant and is assessed by subjective evaluation and measurement data analysis.

RESPONSIBLE PERSON	APPLICABLE STANDARDS	
Facilities Manager	ISO 7730	Indoor Thermal Comfort
	EN 15251-2007, EN 13779	Indoor Environmental Quality

MEASUREMENT FREQUENCY	SOURCE OF DATA
Biannual	1. Occupant Perception Survey 2. Data from Measuring Instruments.

MEASUREMENT METRICS	INSTRUMENT	UNIT OF MEASUREMENT
1. What is the current temperature reading	Thermometer	^{0}C
2. Does temperature fluctuate during the day		
3. Is cold or warm air blowing directly into workstation		
4. Velocity of cold or warm air	Anemometer	feet per minute (FPM)
5. Do occupants complain of draught		
6. Presence of thermal controls		
7. Do employees perceive a thermal comfort problem		

BENCHMARK SCALE		
		%
DEFICIENT		0% - 25%
MINIMUM		25% - 50%
GOOD		50% - 75%
BEST		75% - 100%

INDICATOR VALUE	%

NOTES

Figure 15: An example of indicator card

6.5 RECOMMENDATIONS

In every evaluation procedure, teams have a responsibility to score products, processes or KPIs against a designated set of evaluation criteria as a means of assessing and embarking on changes relevant to ensure constant growth. Upon validating the above set of KPIs, there was a need to produce a clear

assessment of KPIs and provide a rationale that can be used to substantiate decisions. The evaluation procedure involves establishing the evaluation criteria, drawing up a scheme for collecting scores and weights to be assessed against the criteria and finally computing the overall score for each product.

Accenture as a global corporation keeps a comprehensive database of all processes, activities and pilot programs with relevant schematic representations and database. Amidst these sets of data, the research team realised that all the identified metrics are already being measured. To this effect, the KPI metrics were individually scrutinised during the interview. For most parts of the IEQ metrics, the organization's output is scored against the benchmark in the Law 81/2017 whiles the psychosocial aspects of the KPIs are evaluated against the subjective responses of the employees.

Information Distribution throughout the evaluation of KPIs

To ensure the success of the KPIs, the research team inquired on how the company successfully gives feedback back to the workers to ensure appreciation and progress towards attaining a healthy workplace. It was confirmed that the company evaluation requires constant communication between the evaluation team and the sponsor, stakeholders or participating workers. Thus, participants are made to understand what the data seek to rectify and how the solution is intended to be of benefit to everyone involved.

Ensuring Evaluation Integrity

To ensure evaluation integrity of all measurements in the company, all participants of the smart working program in Accenture undergo training before commencing. There, they are advised on the benefits to be derived from participation. In the end, all results are represented on a balanced scorecard. This ensures the integrity of the evaluation procedures. All associated weights, test procedures, and expected outcomes guidelines are communicated before testing is begun.

Creating an Evaluation Timeline

Scheduling is an important part of the evaluation process in order to establish realistic timelines and expectations. It is best to identify individual actions and estimate time required to complete each KPI. The research team identified that data relevant to these sets of KPIs are accumulated semi-annually.

Conclusion on the validation of KPIs

This chapter represents how the prioritization and validation process was carried out by the experts interviewed. They helped to score the relevance of the KPIs with respect to its impact in the assessment of health and well-being of employees. Finally, a guide on how the evaluation of the KPIs can be done was given.

CHAPTER 7 – CONCLUSION AND RECOMMENDATIONS

This research has produced a set of KPIs necessary for assessing the health and well-being of workers in the workplace. This chapter assesses how the aim of this research which is to assist organizations to deal with the impacts of NWW on employees' health and well-being. It is presented in four parts; (1) main findings of the research (2) implications and contribution to practice (3) limitation of study and (4) recommendation for further research.

7.1 FINDINGS

The main findings of this research are the development of methods to measure health and well-being within the context of New Ways of Working (NWW). Two distinct approaches to measuring the health and well-being of employees were realized. They are as follows

- A consolidated measurement approach as described in section in 4.4 and
- A list of validated KPIs necessary in measuring health and well-being within the NWW as shown in Table 30.

The above findings were comprehensive in assessing every aspect of employees' health and well-being such as their psychosocial stress, mental stress, physiological and others as deliberated already in sections 3.2 and 3.3.

Research Objective: *To develop and validate a system of key performance indicators that can be used for measurement of health and well-being in the workplace.*

The main objective of this research was satisfied by assigning research questions that streamlined the work into the fulfilment of this objective.

Research Question 1: How does NWW affect the health and well-being of workers?

A pre-informed perception exists that NWW as being characterised by flexibility seems to bring a balance in the life of a worker, this somehow downplays its possible negative effects. Although several works of literature have proven this, the findings of this research explicitly provided comparative evidence that shows both the existence of its positive and negative impacts on the health and well-being of workers. For instance, although a worker may benefit from a decrease in time spent in commuting now spent on working, the downside is a worker tends to adopt longer and irregular working hours which are often informal and unpaid. As the positive impact benefits the worker, the downside is detrimental to their health.

Research Question 2: What are the current practises for measuring health and well-being in the workplace?

This research identified three existing approaches to measuring or in some cases assessing the health and well-being of workers in a workplace. It was observed that each measurement approach focused only on a section of the health of the worker. The first approach focused solely on psychosocial health. The second method was paramount in gathering only the empirical data such as heart rate monitoring responses of workers whiles performing their everyday roles. Finally, the last approach, focused on assessing if all the provisions of the Health and Safety standards and other provisions are met in a workplace, based on that, the health is assessed. In the end, the authors derived a more comprehensive approach that factored only the key ideologies of the approaches identified.

Research Question 3: Are there in existence a set of actionable KPIs relevant to assessing the health and well-being of knowledge workers?

Indeed, a whole lot of performance indicators were identified. Although some were far-fetched others were synonymous to a selection from different authors. A thorough approach was implemented which yielded a total of 19 KPIs validated and ranked in terms of relevance to the health and well-being of the worker. An AHP process was used in ranking the KPIs. In the end, thermal control measures came off as the KPI having the highest priority and biophilic design comfort had the lowest

Research Question 4: How can a selection of KPIs help to measure the impacts of NWW on the health and well-being of workers?

Ultimately, the KPIs proposed caters for all the psychosocial work factors through the aid of identified metrics attributed to the KPIs. Those can be drilled further to individually assess every bit of the measures that make up the KPI. A similar solution goes for all the physical stresses as well. Thus, this selection of KPIs leaves no section of the workers' health and well-being uncaptured.

7.2 PRACTICAL IMPLICATION

This research took a salutogenesis approach which according to Mittelmark and Bauer (2016) stands for an approach that focuses on factors that support human health and well-being, rather than on factors that cause diseases. The research started off with discovering ways to measure the health and well-being of workers before any illness is caused. It progressed systematically to identifying measurement methods and ending with a list of KPIs. This preventive approach indirectly enhances a healthy work culture in an organization thus increasing productivity in the long run.

The list of 19 KPIs generated is adaptable to every industry. Although in this research the emphasis was on the New Ways of Working and emphatically to coworking and smart working arrangements,

these KPIs are suitable for every workplace as well.

A further benefit is derived from the fact that these KPIs were ranked in terms of most relevant to the least relevant. So, workplace managers, designers or architects can design having in mind the ranking of KPIs. This is essential in the planning phase of projects where there ought to be a trade-off in one way, this ranking could assist in the decision analysis.

The long-term goal of this research is geared towards the advancement of the state of the art and contribution to the field of workplace management through highlighting the health impacts of the new ways of working on employees' health and well-being.

7.3 LIMITATIONS TO STUDY

This study is limited to the fact that the proposed KPI prioritization is only applied in one company. This limitation is defined by differences that may exist among different industries, cultures and countries. Although the performance metrics prioritization can possibly be adapted to similar companies, the results of the analysis and evaluation cannot be implemented directly in other companies as it's only relevant when it's been adapted to the strategic goal of the company. Despite this, the benefit of this approach outweighs the limitation considering the aim of the research study. However, caution should be taken when generalising the findings reported.

7.4 RECOMMENDATION FOR FURTHER RESEARCH

The development of KPI is often an advanced continuous process. Therefore, there is a need for more longitudinal observational study in the workplace to help track the trends of these impacts on health identified in this research for further improvement of the KPIs.

The working culture is largely influenced by factors such as industry types, culture, etc., and varies across different countries. It is recommended that comparative studies should be conducted on the development and prioritization of KPI dedicated to the impact of health and well-being in order to eliminate any form of discrepancies in results.

It is recommended that researchers conduct studies that emphasize on the importance for companies to invest in measurement equipment to support the assessment of workers' health with subjective measurements.

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APPENDIX

Appendix 1

Interview questions

1. As a company, how do you define a healthy workplace?

2. What are the main provisions of Law N. 81/2017 on “Lavoro Agile” (Smart Working) companies should be aware?

3. How is your company presently implementing smart working for its employees?

4. What flexible work schedules can employees opt for in your company?

5. What steps do employees take in order to engage in smart working?

6. Does your company have any innovative tools (Such as wearable sensors or smart applications) specifically dedicated to gather information on the health of employees?

7. If yes, what are they?

8. Do employees receive any fee for designing their home workstation to confirm with the required standard (For example, in terms of ergonomics or indoor environment quality)?

9. How do you ensure that your employees are abiding by the rules of flexible working provided in the law when working out of the company premises?

10. Has there been any assessment conducted so far on the impact smart working has on employees engaging in it?

11. What were the findings of this assessment?

#	Questions for Ranking KPIs	
1	Are these KPIs relevant for assessing health & well-being in your workplace?	
2	Do you want to add any KPI to the list?	
3	What are your general comments on the KPI list?	
4	What level of impact will you attribute to these KPIs with respect to assessment of health and well-being of employees?	

#	KPI & Description	Possible Metrics	Scale 1	2	3	4	5	6	7	8	9
1	Adequate Luminance										
	Luminance in the workplace represents the adequate amount of light that impignes upon, emitted from or is reflected from the workstation of the worker as such avoids occupant from eyesight problems.	Presence of Optimum Natural Lighting for tasks									
		Adequate artificial luminaire									
		Uniform illumincance on task area									
		The ratio of the minimum illuminance to the average illuminance on the background area									
		Uniform illumincance on immediate surrounding area									
		Appropriate Technology for Visual Comfort									
2	Air Quality Control Measures										
	Air Quality control measures refer to the techniques employed to reduce or eliminate the emission into the workspace, substances that can harm the occupant's health	Usage of zero-emission finishes /VOC control									
		What is the quality of the indoor air delivered through mechanical ventilation?									
		Presence of man-made vitreous fibres, tobacco smoke, particulate matter,									
		Appropriate Design Technology for maintaining purifying ventilated air.									
		Absence of conditions for Mould Growth									
		Does the system provide sufficient ventilation?									
		How effective is the system in delivering air to each space?									

3	Availability of Acoustic Comfort measures											
	Acoustic comfort refers to the state where an occupant classifies the space as sound and void of noise that induces stress reactions and a decreased sense of general well-being. Occupants are affected by the levels and nature of sound experienced.	Average noise interruption from colleagues										
		Noise from Mechanical plants (Winter/summer air-conditioning)										
		Sound Reverberation in workplaces										
		Grouping similar types of areas together										
		Sound masking systems in open offices										
		Policy in place addressing proper workplace etiquette WP to promote courteous behaviours related to generating unwanted noises for other people surrounding										
		Construction methods for acoustic control										
		Presence of Phone booths and concentration rooms										
		Occupant satisfaction with level of sound privacy										
4	Availability of Natural Ventilation											
	Refers to the process of moving outdoor air into a building naturally through windows or doors, and distributes the air within the worrk space. The warm and dirty air inside of the building are forced out through the opening in the roof. Achievd through wind-based or buoyancy-driven ventilation.	How effective is natural ventilation?										
		Natural Ventilation times in the year										
		Occupants comfortability in natural ventilation										
		Is there a need for mechanical plants to aid in Natural ventilation?										
5	Biophilic Design Comfort											
	Biophilic design stands for the concept of designing to increase occupant connectivity to the natural environment by the use of direct nature, indirect nature, and space and place conditions.	Presence of greenery in workplace										
		Occupant satisfaction with look and feel of										
		Occupant Proximity to window										
		Presence of scenicviews from windows										
6	Civility and Respect											
	This depicts a work environment where employees are respectful and considerate in their interactions with one another, as well as with customers, clients and the public	Is aggressiveness rare among you and your coworkers?										
		Are you exposed to conflicting demands from others?										
		Is the atmosphere in the workplace good?										
7	Engagement, Influence and Involvement											
	This decribes a workplace where workers are included in discussions about how their work is done and how important decisions are made.	Do you have a large degree of influence concerning your work?										
		Do you have enough freedom to decide how you want to do your job?										
		Do you have much say about what happens in the workplace?										

8	Glare Control Mechanism											
	Glare refers to the difficulty of seeing in the presence of a bright light which may be caused as a reflection of a bright source of light. Glare at workstations may be caused by either artificial or natural sources or light.	Occupant discomfort glare from natural lighting										
		Daylighting discomfort glare in the immediate surrounding area										
		Discomfort glare due to artificial lighting										
		Spectral reflectivity of worksurfaces										
		Can occupant relocate in the case of Glare?										
		Amount of hours in day where Glare is experienced										
9	Growth and Development											
	This represents a workplace where workers receive encouragement and support in the development of their interpersonal, emotional and job skills.	Do you have the possibility of learning new things through your work?										
		Do you try to find out what you can do to solve a problem?										
		Do your job require you to assimmilate new knowledge?										
		Do your job require you to be creative?										
		Do you have the opportunity to develop new skills?										
10	Job Content											
	This decribes a workplace where there is recognition of the need for balance between the demands of work, family and personal life.	Does your job require you to work very quickly?										
		Does your job require you to work very hard?										
		Does your work include some repetitive tasks?										
		Does your work include many activities?										
		Does your work require that you remember a lot of things?										
11	Leadership, Role Clarity and Expectation											
	This describes how effective leadership support help workers know what they need to do, how their work contributes to the organization and whether there are impending changes.	Do your superiors serve as role models?										
		Are contradictory demands placed on you at work?										
		Are you informed in advanced about important decisions, changes or plans for the future?										
		To what extent would you say that your superior is good at work planning?										
12	Organizational Culture											
	This describes the patterns an organization has developed to cope with issues related to its internal integration and external adaptation characterized by trust, honesty, fairness and collaboration among workers.	Do you enjoy telling others about your workplace?										
		Do you have a clearly-outlined wellness policy at work?										
		How well has your desired culture been internalised & understood?										
		Is your organizational culture a daily practice?										

		How do new employees describe the culture?										
13	Positive Social Climate											
	This describes a work environment where there is a good fit between employees' interpersonal and emotional competencies and the requirements of the position they hold.	Is your work emotionally demanding?										
		Does your work require that you hide your feelings?										
		Can you decide when to take a break?										
		How pleased are you with the people you work with?										
14	Psychosocial Support											
	This implies creating an atmosphere where coworkers and supervisors are supportive of workers' psychological and mental health concerns, and respond appropriately as needed.	How often do you get help and support from your colleagues?										
		Is the atmosphere in the workplace good?										
		How often does your superior talk with you about how well you carry out your job?										
15	Recognition and Reward											
	This represents a workplace where there is appropriate acknowledgement and appreciation of [illegible]	Are you being recognised by management?										
		Is your salary fair in relation to your effort at work?										
16	Safe Working Environment											
	This describes a work environment where management takes appropriate action to protect the physical safety of employees.	Is there a shift or location that is most prone to incidents?										
		Does an employee's time with the company have an impact on their likelihood to become involved in incidents?										
		What are the most often occurring types of employee injuries?										
17	Space Layout and Ergonomic Furnishing Comfort											
	Space layout in the workplace context refers to the method an organization has arranged the workplace for ease of movement and zoning of areas to support activities. Additionally the kind of furnishings at the workplace are under this section.	Occupant satisfaction with furnishing										
		How adaptable is the space to occupant										
		Occupant's satisfaction with comfort of office furniture										
		Does layout facilitate peer-to-peer communication										
		Number of ways furniture can be adjusted to meet needs of the user										
		Occupant satisfaction with ease of interaction										
		Knowledge sharing capabilities										
		Occupant satisfaction with visual privacy										
		Total amount of space allocated to each member for work										
		Presence of task based spaces that encourage standing										
		Flexibility and Provision of Social Spaces										

18	Thermal Comfort Measures											
	Thermal comfort is the condition of mind that expresses satisfaction with the thermal environment of an occupant and is assessed by subjective evaluation	Design Provision of Thermal Control										
		Air temperature and Air cooling with mechanical cooling										
		What is the Predicted mean reading during summer?										
		Air Velocity and Draught Risk										
		What is the Predicted mean reading during winter.										
		Air Temperature and air humidity levels										
		Means of Regulating Thermal Controls										
19	Workload Management											
	This explains how tasks and responsibilities can be accomplished successfully within the time available.	Do you have enough time to finish your work?										
		Are you required to do excessive work?										
		Do your work include many activities?										

AHP Scoring																			
	Adequate Luminance	Air Quality Control Measures	Availability of Acoustic Comfort measures	Availability of Natural Ventilation	Biophilic Design Comfort	Civility and Respect	Engagement, Influence and Involvement	Glare Control Mechanism	Growth and Development	Job Content	Leadership Role Clarity and Expectation	Organizational Culture	Positive Social Climate	Psychosocial Support	Recognition and Reward	Safe Working Environment	Space Layout and Ergonomic Furnishing Comfort	Thermal Control Measures	Workload Management
Adequate Luminance	1	0.33	5.00	0.33	7.00	5.00	7.00	3.00	5.00	0.33	1.00	1.00	3.00	1.00	5.00	0.33	5.00	0.20	0.33
Air Quality Control Measures	3.00	1	3.00	0.33	5.00	3.00	9.00	3.00	3.00	1.00	3.00	3.00	3.00	2.00	5.00	1.00	5.00	0.20	1.00
Availability of Acoustic Comfort measur	0.20	0.33	1	0.14	7.00	1.00	3.00	0.33	1.00	0.14	0.20	0.20	0.33	0.20	1.00	0.14	0.33	0.11	0.14
Availability of Natural Ventilation	3.00	3.00	7.00	1	9.00	7.00	9.00	5.00	5.00	1.00	3.00	3.00	3.00	0.50	5.00	1.00	7.00	0.33	1.00
Biophilic Design Comfort	0.14	0.20	0.14	0.11	1	0.33	0.33	0.14	0.33	0.11	0.14	0.14	0.20	0.14	0.33	0.11	0.33	0.11	0.11
Civility and Respect	0.20	0.33	1.00	0.14	3.00	1	3.00	2.00	1.00	0.14	0.20	0.20	0.33	0.20	1.00	0.14	0.20	0.14	0.14
Engagement, Influence and Involvemer	0.14	0.11	0.33	0.11	3.00	0.33	1	0.50	0.33	0.11	0.14	0.14	0.20	0.20	0.33	0.11	0.14	0.14	0.11
Glare Control Mechanism	0.33	0.33	3.00	0.20	7.00	0.50	2.00	1	1.00	0.14	0.20	0.20	0.33	0.25	0.33	0.14	0.20	0.14	0.14
Growth and Development	0.20	0.33	1.00	0.20	3.00	1.00	3.00	1.00	1	0.20	0.20	0.20	0.33	0.33	1.00	0.14	0.20	0.14	0.14
Job Content	3.00	1.00	7.00	1.00	9.00	7.00	9.00	7.00	5.00	1	2.00	2.00	3.00	3.00	7.00	1.00	3.00	2.00	1.00
Leadership Role Clarity and Expectation	1.00	0.33	5.00	0.33	7.00	5.00	7.00	5.00	5.00	0.50	1	1.00	3.00	1.00	5.00	0.33	1.00	0.33	0.33
Organizational Culture	1.00	0.33	5.00	0.33	7.00	5.00	7.00	5.00	5.00	0.50	1.00	1	3.00	1.00	5.00	0.33	3.00	0.50	0.33
Positive Social Climate	0.33	0.33	3.00	0.33	5.00	3.00	5.00	3.00	3.00	0.33	0.33	0.33	1	0.33	3.00	0.33	0.33	0.33	0.20
Psychosocial Support	1.00	0.50	5.00	2.00	7.00	5.00	5.00	4.00	3.00	0.33	1.00	1.00	3.00	1	5.00	0.33	0.33	0.50	0.33
Recognition and Reward	0.20	0.20	1.00	0.20	3.00	1.00	3.00	3.00	1.00	0.14	0.20	0.20	0.33	0.20	1	0.14	0.33	0.20	0.14
Safe Working Environment	3.00	1.00	7.00	1.00	9.00	7.00	9.00	7.00	7.00	1.00	3.00	3.00	3.00	3.00	7.00	1	3.00	2.00	1.00
Space Layout and Ergonomic Furnishing	0.20	0.20	3.00	0.14	3.00	5.00	7.00	5.00	5.00	0.33	1.00	0.33	3.00	3.00	3.00	0.33	1	0.33	0.33
Thermal Control Measures	5.00	5.00	9.00	3.00	9.00	7.00	7.00	7.00	7.00	0.50	3.00	2.00	3.00	2.00	5.00	0.50	3.00	1	0.50
Workload Management	3.00	1.00	7.00	1.00	9.00	7.00	9.00	7.00	7.00	1.00	3.00	3.00	5.00	3.00	7.00	1.00	3.00	2.00	1

Appendix 4: Normalized Values and Priority Vectors

NORMALIZED VALUES																					
		KPI1	KPI2	KPI3	KPI4	KPI5	KPI6	KPI7	KPI8	KPI9	KPI10	KPI11	KPI12	KPI13	KPI14	KPI15	KPI16	KPI17	KPI18	KPI19	**Priority Vector**	**Ranks**
KPI1	Adequate Luminance	0.04	0.02	0.07	0.03	0.06	0.07	0.07	0.04	0.08	0.04	0.04	0.05	0.08	0.04	0.07	0.04	0.14	0.02	0.04	**0.054383301**	**9**
KPI2	Air Quality Control Measures	0.12	0.06	0.04	0.03	0.04	0.04	0.09	0.04	0.05	0.11	0.13	0.14	0.08	0.09	0.07	0.12	0.14	0.02	0.12	**0.080167818**	**6**
KPI3	Availability of Acoustic Comfort measures	0.01	0.02	0.01	0.01	0.06	0.01	0.03	0.00	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02	**0.01573044**	**15**
KPI4	Availability of Natural Ventilation	0.12	0.19	0.10	0.08	0.08	0.10	0.09	0.07	0.08	0.11	0.13	0.14	0.08	0.02	0.07	0.12	0.19	0.03	0.12	**0.100571688**	**5**
KPI5	Biophilic Design Comfort	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	**0.007423195**	**19**
KPI6	Civility and Respect	0.01	0.02	0.01	0.01	0.03	0.01	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02	**0.01510213**	**17**
KPI7	Engagement, Influence and Involvement	0.01	0.01	0.00	0.01	0.03	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01	0.01	**0.008817071**	**18**
KPI8	Glare Control Mechanism	0.01	0.02	0.04	0.02	0.06	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.02	0.01	0.01	0.02	**0.016882087**	**13**
KPI9	Growth and Development	0.01	0.02	0.01	0.02	0.03	0.01	0.03	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02	**0.015246022**	**16**
KPI10	Job Content	0.12	0.06	0.10	0.08	0.08	0.10	0.09	0.10	0.08	0.11	0.08	0.09	0.08	0.13	0.10	0.12	0.08	0.19	0.12	**0.100693341**	**4**
KPI11	Leadership Role Clarity and Expectation	0.04	0.02	0.07	0.03	0.06	0.07	0.07	0.07	0.08	0.06	0.04	0.05	0.08	0.04	0.07	0.04	0.03	0.03	0.04	**0.051775162**	**10**
KPI12	Organizational Culture	0.04	0.02	0.07	0.03	0.06	0.07	0.07	0.07	0.08	0.06	0.04	0.05	0.08	0.04	0.07	0.04	0.08	0.05	0.04	**0.055483995**	**7**
KPI13	Positive Social Climate	0.01	0.02	0.04	0.03	0.04	0.04	0.05	0.04	0.05	0.04	0.01	0.02	0.03	0.01	0.04	0.04	0.01	0.03	0.02	**0.030659373**	**12**
KPI14	Psychosocial Support	0.04	0.03	0.07	0.17	0.06	0.07	0.05	0.06	0.05	0.04	0.04	0.05	0.08	0.04	0.07	0.04	0.01	0.05	0.04	**0.055183117**	**8**
KPI15	Recognition and Reward	0.01	0.01	0.01	0.02	0.03	0.01	0.03	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	**0.016148668**	**14**
KPI16	Safe Working Environment	0.12	0.06	0.10	0.08	0.08	0.10	0.09	0.10	0.11	0.11	0.13	0.14	0.08	0.13	0.10	0.12	0.08	0.19	0.12	**0.106922221**	**3**
KPI17	Space Layout and Ergonomic Furnishing Comfort	0.01	0.01	0.04	0.01	0.03	0.07	0.07	0.07	0.08	0.04	0.04	0.02	0.08	0.13	0.04	0.04	0.03	0.03	0.04	**0.04611844**	**11**
KPI18	Thermal Control Measures	0.19	0.31	0.12	0.25	0.08	0.10	0.07	0.10	0.11	0.06	0.13	0.09	0.08	0.09	0.07	0.06	0.08	0.09	0.06	**0.11300448**	**1**
KPI19	Workload Management	0.12	0.06	0.10	0.08	0.08	0.10	0.09	0.10	0.11	0.11	0.13	0.14	0.13	0.13	0.10	0.12	0.08	0.19	0.12	**0.109687452**	**2**