Padia, S., Divatia, A., & Saripally, D. (2022). Employee's Mental Wellbeing with reference to IEQ and Managerial Environment in Office Spaces. *Proceedings of the 30th Annual Conference of the International Group for Lean Construction (IGLC30),* 623–634. doi.org/10.24928/2022/0167

EMPLOYEE'S MENTAL WELLBEING WITH REFERENCE TO IEQ AND MANAGERIAL ENVIRONMENT IN OFFICE SPACES

Shubham Ashok Padia[1], Ami Divatia[2], and Durga Saripally[3]

ABSTRACT

Pre-corona the economy flourished but number of employees suffering from mental-wellbeing issues was rising. This set the stage for understanding the relationship between workplace mental-wellbeing, Indoor environment quality and Managerial Environment. As employees are a significant expenditure for companies, human-centric design and workplace optimization is gaining ground. WHO reported that the costs incurred on the global economy because of depression and anxiety was estimated as 1-trillion US dollars per-annum in lost productivity in 2019. This lost in cost and productivity can be considered as waste which can be eliminated by using Lean construction to optimize the workplace environment. Therefore, the main research question here was to know that to what extent the IEQ parameters and Managerial Environment, relate to mental wellbeing while working at corporate office spaces. Employees of diverse scale firms of Ahmedabad were considered. A mixed-research methodology was being adopted and data was collected by means of a questionnaire survey and interviews. Data analysis was done with the help of descriptive and inferential statistics of the survey and coping strategies were noted with the help of interviews. This study would be a thirst area for a balanced work-environment considering the physical, social, and mental wellbeing of the employees.

KEYWORDS

Lean construction; safety, quality, health; waste; mental wellbeing; workplace optimization.

INTRODUCTION

The impact of the built environment on individual was obvious, yet not well-understood. To date the architecture, engineering and construction (AEC) industry has been strongly focused on minimizing any undesirable impact of design by improving efficiency. The regenerative approach recommended possible interactive components from a human perspective, and that were social interaction; IEQ in terms of visual and physical comfort; occupant productivity eventually increased health and well-being (Craft et al., 2017). As employees are significant expenditure for most companies, human-centric

[1] VDC Project Engineer at vConstruct Private Limited and Post-Graduate student from CEPT University, India, +91- 8401683451, shubhamashokpadia@gmail.com
[2] Freelance Researcher consultant and Visiting Faculty, CEPT University, Ahmedabad, India, +91 – 9898246887, amidivatia@yahoo.co.in
[3] Operations Manager, vConstruct Private Limited, Pune, India, +91- 8446001611, durgas@vconstruct.in

design and workplace optimization are gaining ground (Watson, 2018). However, the correlation between mental wellbeing and IEQ at office spaces were not well understood (Mujan et al., 2019). Managerial environment was also one of the major factors which affects the employee's wellbeing. Quick et al., (2007) tells that the organization whose leaders are healthy, tends to maintain the organization's vitality, productivity and completive edge over their competitors. According to research by Cobaleda Cordero et al., (2019) and Jensen & van der Voordt, (2019) an evidence-based approach research was required to clarify the correlation between employee's mental wellbeing and the IEQ. The study by Oswald et al., (2019) emphasis that majority of the lean concepts discusses about the physical aspects rather than mental aspects of an individual. Thus strategies need to be developed using the lean construction concepts to improve the loss in productivity and minimize the cost incurred due to this ill-effect in construction industry. The need was further supported considering the change in mental health and IEQ on employees in post COVID-19 situation in AEC sector.

The main objective of this research was to find the correlation between IEQ conditions, managerial environment and employee's well-being in office spaces which will provide evidence-based recommendations to scientific researchers, policymakers, and practitioners. In order to attain this primary objective, several sub-objectives were formulated:

1. To find out the parameters for mental wellbeing by reviewing extensive literature review.
2. To study the relationship between personal characteristics, IEQ and managerial environment parameters with mental being of the employee.
3. To study how personal character affect the perception of IEQ parameters, Managerial Environment factor and mental wellbeing of the employee.
4. To observe the variation of IEQ and managerial environment on mental wellbeing due to size of organization.

LITERATURE REVIEW

WHO, (2004) defines mental health as "…a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community". Based on extensive literature review variables associated with mental wellbeing has been identified. *Concentration, Fatigue/ Tiredness/ Insomnia/ Sleep Quality:* Fatigue is "the state of feeling very tired, weary or sleepy resulting from insufficient sleep, prolonged mental or physical work, or extended periods of stress or anxiety" by Canadian Centre for Occupational Health and Safety, (2017). Effects were reduced communication skills, productivity, ability to handle stress, increase in reaction time, Caldwell et al., (2019). Lighting conditions can also have impact on employee's cognitive processes both in positive and negative way. *Depression/ Anxiety, Emotional Exhaustion, Mood:* Depression is "a serious event with which an individual cannot cope adequately". *Motivation/ Engagement/ Burnout:* Employee's engagement is "a distinct and unique construct that consist of cognitive, emotional, and behavioral components that are associated with individual role performance", Saks, (2006). *Performance/ Productivity:* Bubonya & Cobb-clark, (2017) investigated the link between mental wellbeing and workplace productivity measures which were absenteeism and presentism which have direct effect on lean construction principles. IEQ parameters like thermal comfort, air quality and acoustics were also found related to employee's

workplace productivity, Horr et al., (2016). *Stress:* Stress means "a significant life event or change that demands response, adjustment, or adaptation" (Stangor & Walinga, 2014). Lighting conditions were also found relevant with the workplace stress.

Indoor Environmental Quality (IEQ) means "the condition of the inside of a building" by (Geng et al., 2017a). *Satisfaction with temperature:* Satisfaction with temperature is a subjective evaluation which means an expression of satisfaction with thermal environment (ANSI/ASHRAE, 2017). Productivity and thermal satisfaction has found to be positively correlated in the study by Geng et al., (2017b). *Satisfaction with Indoor Air Quality:* Indoor pollutants like volatile organic compounds (VOCs), fine particles (PM) and carbon dioxide affects the IAQ conditions therefore proper ventilation in office spaces is necessary. As an energy conservation measure in early 1980s, the commercial ventilation rate requirement has been lowered which led to more building related illness which is also known as sick building syndrome (SBS) (Allen et al., 2016). *Satisfaction with sound level:* Horr et al., (2016, p.6) in the study distinguished the acoustic problem of office environment. This causes distraction and it usually takes 15-20 minutes as a recovery time to get the concentration. Productivity is thus also affected by noise disturbance which thereby increases the mental workload of employees. *Satisfaction with lighting:* For a lighting system there were several requirements i.e., "providing enough light, create neither discomfort, glare nor reflections, be without flicker and well distributed, and provide acceptable colour rendering". The decline in productivity has been observed by Eklund & Boyce, (1996) on their office lighting survey when the expectation of the employees is not met. Work engagement has also been included in this model in further research by J. A. Veitch et al., (2013). The model shows the strong effect of work engagement and lighting conditions.

For managerial environment the factors found from the literature review were as follows. *Effective communication* enhances personal growth of an employee in an organization by King, (1992). There should be *career development planning and growth* programme offered by the organization to their employees so that they can maintain their skills and can remain useful to the organization. *Organizational Commitment* has positive and significant effect on job performance i.e., more committed employees performs better in their job (Walton, 1985). There should be an *emotional support from the supervisor* towards their employee to maintain their energy levels by discussing about their problems to reduce the mental stress of the employee which can help in boosting their work performance (Lapierre & Allen, 2006). *Flexible Work Arrangement* also helps their employee's by increasing their motivation and dedication towards organization. *Job Satisfaction* means that to what extend the employee is enthusiastic or satisfied about the job (Aryee et al., 1999). *Rewards and Benefits/ Compensation* for the employee's generally includes rewards, social support, fulfilment of reasonable demand and influence over decisions. This can enhance the mental wellbeing of the employees (Lowe et al., 2003).

Next parameters related to personal characteristics of the employees were selected. Frontczak & Wargocki, (2011) in the study talks about the relation of IEQ with the human comfort where it has been concluded that personal characteristics like *age*, type of job and country of origin has a significant effect. *Gender* of the employee is also considered as one of the important parameters in knowing occupant's office perception relating IEQ (Kim et al., 2013). In this study, significant relationship between the gender and sick leaves has also been observed. Murray et al., (2003) in the study shown that *household composition* was also an important parameter considering the mental

wellbeing of the employee like sleep quality, depression and emotional exhaustion. The factor selected were *firm type, firm size, age, gender, personality, household composition, management level* of the employees. This research was needed because the newer generation employees will need a balance work environment considering their physical, social and mental wellbeing as this balance resulted into employee being able to work and flourish across the organization. Thus, improving the productivity of the employee and reducing the waste in terms of cost using lean construction principles since its major pillar is waste reduction.

RESEARCH METHODOLOGY

All the parameters related to each group were collected through extensive literature review. It was followed by Mix design research approach where data was collected by means of questionnaire and interviews. Questionnaire survey was prepared and scored according to existing scientific scales. Interview of field expert viz. psychologist (Qualification – Masters and Doctorate in Psychology) and Architects (Qualification – Bachelors and Master's in architecture) were used to know the coping strategies. Descriptive and Inferential statistical techniques were used to analyze the collected data using IBM SPSS Software and Microsoft Excel.

The questionnaire survey was validated by the field experts for mental wellbeing concepts, managerial environment concept and IEQ concepts of the study. Experts had to rate each question for its relevance and unambiguity and the feedbacks were incorporated while forming questionnaire. The data was collected by means of questionnaire survey using Google form and printed copies. Identifier codes (pseudonym) were also provided to each survey questions for better linking of data. Stratified sampling procedure was adopted for finding the sample size for number of responses.

Pilot study of the 30 responses was conducted and their reliability was checked using Cronbach alpha using IBM SPSS software. From pilot study it was observed that the response rate was low on Google form so printed copies were also distributed among the firms. For the reliability test for IEQ parameters, the value of alpha was observed as 0.903, for ME parameters, the value observed was 0.877 and for MW parameters, the value observed was 0.933. The value of alpha (> 0.5) showed that all the three scales were reliable. A total of 151 responses were collected after removing the outliers. Interviews of 4 psychologist and 6 architects were conducted. Descriptive analysis was carried out using mean, median, and standard deviation. Inferential Statistics viz. paired t-test, chi-square test and Pearson's r with significance level of 5% were used to test hypothesized relationship.

DATA COLLECTION

It was found that there were almost equal proportion of respondents from consultancy and contracting firms. Half of the data collected was from small scale firms which was followed by medium and large-scale firms. It was noticed that half of the respondents from the sample were from middle level management followed by equal proportion of respondents from low level management and top-level management. More than seventy percentage of the sample were male and around 30% of sample were female. Around 85% of the sample consist of young age group between age of 24-36 years and few were more than 37 years old. Five major personality traits viz. extraversion, agreeableness,

conscientiousness, neuroticism, and openness were noticed among the respondents from the fifteen personality related items.

FINDINGS AND INTERPRETATION

Indoor environmental quality related items were asked to the respondents, and it has been observed that three-fourth of the population were not satisfied with the temperature of their office space. Around sixty percentage of the respondents were neither satisfied with air quality nor sound level or lighting condition in their office. The overall score of the IEQ satisfaction was categorized using the mean and two classes were prepared. It was observed that 55% of the population was not satisfied about their overall satisfaction with indoor environmental quality (Figure.1).

In consultancy firms it was noted that around 52% of the employees and in contracting firms around 42% of the employees were not satisfied with their indoor environmental quality of their office space. In small scale firms, major issue about the satisfaction with indoor environmental was observed with 50% of the population. Tt was observed that 70% of the male's shown dissatisfaction with IEQ. Respondents having the age group between 24 years to 36 years showed the higher dissatisfaction (75%) with IEQ in their office space compared with other age groups. Among the respondents who were not satisfied with the IEQ of the office spaces, 60% of them were from middle level management and around 30% were from low level management. Again, from the respondents who were not satisfied with the IEQ of the office space 60% belong from nuclear family and 25% belongs from joint family.

About *Managerial Environmental* related items, it was observed that around fifty-five percent of the respondents were dissatisfied towards the proper communication in their firms whereas 50% of them shown the dissatisfaction towards the proper career development and growth program in their firms. Three-fourth of the respondents stated that there was no commitment of work in the employees and no emotional supervisory support within the firms. Three-fourth of the population didn't have any flexible arrangement for work for their employees in the firms, also fifty-five percent of population were lacking in rewards and benefits for employee's wellbeing in the organization. All these factors led to job dissatisfaction among 75% of the respondents in the organization. Fairly equal proportion of the respondents shown satisfaction and dissatisfaction with their overall managerial environment of office space (Figure.1).

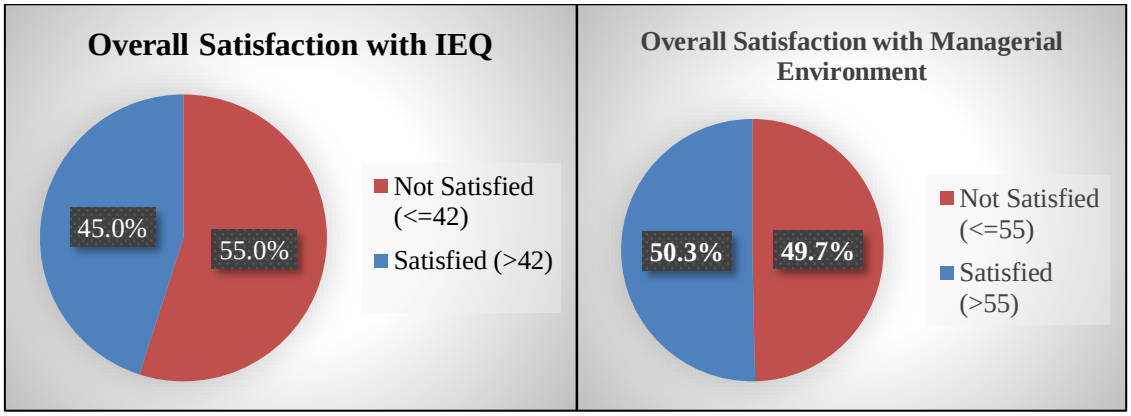

Figure 1: Overall satisfaction with IEQ and Managerial Environment

It has also been observed that fifty-five percent of the respondents were not satisfied with their managerial environment in office space in consultancy firms whereas 45% of respondents were not satisfied in contracting firms. Small scale firms were account for 55% of the respondents who were not satisfied with the current managerial environment followed by medium scale firms (36%). More than three-fifth of the total who were not satisfied with the current managerial environment was males. Again four-fifth of the respondents who were not satisfied with the current managerial environment lied between the age group of 24 years to 36 years. Among the respondents who were not satisfied about the managerial environment in their office space, three-fifth were from middle level management. Three-fifth of the respondents belonged to nuclear families who were not satisfied with their managerial environment in their office space. From those who were not satisfied with their managerial environment of their office space, 78% of them were also not satisfied with their IEQ of the office space

Then *Mental Wellbeing* related items were asked to the respondents. It was observed that around 60% of the population was experiencing the stressful environment in their office space. Fatigue and poor sleep quality has been observed in around three-fifth of the respondents. Three-fifth of the respondents reported that there was trouble in concentration and were emotionally exhausted while working in the organization. Decrease in productivity has been observed in 80% of the respondents. There was not much noticeable difference in the degree of engagement towards the work in the firms. Around 66% of the respondents were suffering from depression to some extend from the population and 52% of the population were having bad mood. Also, for overall mental wellbeing, more than half of the respondents were not so healthy as compared to healthy respondents.

It was observed that more than fifty per cent of the respondents who were not so healthy with their mental wellbeing belonged to consultancy firms while others from contracting firms. Firm size also matters, it has been observed that three-fifth of the mentally unhealthy respondents belonged to small scale firms, followed by medium and large-scale firms. Three-fifth of the mentally not so healthy respondents were male and other 40% were female. Again, the age group of 24 years to 36 years constitute the major part (78%) of mentally not so healthy employees (Table.1).

Table 1: Mental Wellbeing relation with personal characteristics

		Mental Wellbeing				
		Not so Healthy		Healthy		Total
		Frequency	Percentage	Frequency	Percentage	
Firm Type	**Consultancy firms**	41	52.6%	38	52.1%	**79**
	Contracting firms	37	47.4%	35	47.9%	**72**
	Total	**78**	**100.0%**	**73**	**100.0%**	**151**
Firm Size	**Small Scale firms**	45	57.7%	33	45.2%	**78**
	Medium Scale firms	23	29.5%	34	46.6%	**57**
	Large Scale firms	10	12.8%	6	8.2%	**16**
	Total	**78**	**100.0%**	**73**	**100.0%**	**151**
Gender	**Male**	49	62.8%	61	83.6%	**110**

	Female	29	37.2%	12	16.4%	**41**
	Other	0	0.0%	0	0.0%	**0**
	Total	**78**	**100.0%**	**73**	**100.0%**	**151**
Age	**<= 23 years**	8	10.3%	8	11.0%	**16**
	24 - 36 years	61	78.2%	49	67.1%	**110**
	>=37 years	9	11.5%	16	21.9%	**25**
	Total	**78**	**100.0%**	**73**	**100.0%**	**151**
Management level	**Low level management**	22	28.2%	15	20.5%	**37**
	Middle level management	43	55.1%	35	47.9%	**78**
	Top level management	13	16.7%	23	31.5%	**36**
		78	**100.0%**	**73**	**100.0%**	**151**
Household composition	**Single**	10	12.8%	6	8.2%	**16**
	Nuclear family	51	65.4%	30	41.1%	**81**
	Joint family	17	21.8%	37	50.7%	**54**
		78	**100.0%**	**73**	**100.0%**	**151**

Fifteen percent of the top-level management respondents were mentally not so healthy. Again, the respondents who were singles has reported only 13% mentally not so healthy. Majority of the mentally not so healthy employees were either from nuclear family or joint family. Out of the population who were not so healthy about their mental wellbeing, 68% of them were also not satisfied with their IEQ and 64% of them were also not satisfied with their managerial environment of the office space.

The interviews were also conducted to know the causes and coping lean strategies to continuously improve mental wellbeing and indoor environmental quality.

Causes of mental wellbeing problems in office spaces:

- Crowding of people inside the office space and lack of private spaces
- Management level of the employees and lack of support from the superiors
- Dark and shady desks/ space near washrooms; lack of fresh air and open spaces
- Slow system and poor internet speed; Improper planning of the work to be done
- No flexible arrangement to work, No incentives
- Peer pressure to work; Don't know when to say "No"
- Unsatisfied with their work; Missing drive to work

Coping Strategies to improve mental wellbeing:

- Companies must have the affiliated psychologist for the employees
- By having proper recreational space in the office like dedicated yoga area or cafes
- Power nap, small exercise like deep breath, pranayama or pressing the stress ball

- Proper incentives for extra work; Allowances for employees and his/her family
- Employees must have proper sleep quality and should maintain the daily routine
- Company must also consult the dietician for the employees
- Employees must feel comfortable in sharing their mental wellbeing issues
- Morning laughter or playing board games; By avoiding screens late night
- By finding out their motivating factors to work efficiently

Reasons of poor mental wellbeing and managerial environment due to IEQ:

- Quietness of the working place; Quality of air; Comfort level
- Satisfaction with temperature and lighting; Location of the office near road
- Employees may feel stressed, depressed, and may get arrogant because of poor IEQ conditions

Coping strategies to have better IEQ condition in office spaces:

- Vedic plaster/ Asian paint/ UPV cement to improve quality of air by reducing EM wave radiation; Need to have constant air circulation/ ventilation in office space
- Landscaping and vertical gardens with plants like sansevieria and crotons to maintain quality of air; Updated and speedy system
- Sound insulation material like double glass windows, gypsum ceiling and wooden flooring for better sound level; Reflective glass to have ambient temperature
- White/ Yellow light lighting with luminance> 4000K which follows LEED criteria to have ambient lighting; By increasing floor to floor height by 30 cm
- HVAC should be designed properly to have ambient temperature
- Playing soft music, wooden finish helps the employees in their work

Next for inferential statistical analysis several hypotheses were formulated and tested.

HYPOTHESES TESTING

$H_{01(a)}$: *There is no significant difference in the perception of IEQ due to gender:*

Paired t-test was used to test the hypothesis. The p value ($p = 0.043 < 0.05$) suggested that the null hypothesis was rejected. The mean IEQ score of male employees (IEQ male=42.41) being higher than that of female employees (IEQ female=38.82) suggested that males perceived IEQ parameters more comfortable than females. The authorities can find the point of discomforts from female employees in order to modify the office spaces and can then provide with better space to female employees.

$H_{01(b)}$: There is no significant difference in the perception of IEQ due to level of management of employees

The p value for the perception of IEQ ($p = 0.008 < 0.05$) suggested that the null hypothesis was rejected. The mean IEQ score of top-level management employees (45.67) was found higher than that of middle level management employees (41.08) which suggested that top level management employees perceived IEQ parameters more comfortable than middle level management employees.

The authorities can find the point of discomforts from middle level and low-level management employees to modify the office spaces and can then provide with better space to middle level and low-level management employees.

H_{02}: *There is no significant difference in the perception of managerial environment due to level of management of employees:*

Paired t-test was used to test the hypothesis. The p value ($p = 0.003 < 0.05$) suggested that the null hypothesis was rejected. The mean ME score of top-level management employees (59.58) was higher than that of middle level management employees (53.84) which suggested that top level management employees perceived ME parameters more comfortable than middle level management employees.

The authorities can find the point of discomforts from middle level and low-level management employees to modify their managerial environment and can then provide with better environment to middle level and low-level management employees.

$H_{03(a)}$: *There is no association between the perception of mental wellbeing and gender.:*

Chi-square test was applied to test the hypothesis of perception of mental wellbeing due to male and female employees. The result ($\chi 2 = 0.004 < 0.05$) suggested that the null hypothesis was rejected, and an association was found between the respondent's gender and their MW.

$H_{03(b)}$: There is no association between the perception of mental wellbeing and household composition:

Chi-square test was applied to test this hypothesis The result ($\chi 2 = 0.001 < 0.05$) suggested that the null hypothesis was rejected, and an association was found between the respondent's household composition and their MW.

$H_{03(c)}$: There is no difference in the perception of mental wellbeing due to level of mgt. of employees:

Paired t-test was used to test the hypothesis. The p value ($p = 0.017 < 0.05$) suggested that the null hypothesis was rejected. The mean MW score of top-level management employees (180.41) was higher than that of middle level management employees (168.53) which suggested that top level management employee's MW was better than middle level management employees. Further the difference in perception was also tested between top level and low level management. The p value ($p = 0.016 < 0.05$) suggested that the null hypotheses was rejected. The mean MW score of top-level management employees (180.41) was found higher than that of low-level management employees (165.94) which suggested that top level management employees had better MW than low level management employees. Moreover, correlations were performed between:

i) IEQ and ME ($r = 0.578 > 0.5$), ii) IEQ and MW($r = 0.377 < 0.5$) and iii) ME and MW($r = 0.559 > 0.5$). These correlations and respective "r" values inferred that IEQ was significantly related with ME but not related to MW. Hence, better IEQ could improve managerial effectiveness but not mental wellbeing. Also to note here that Managerial effectiveness was significantly related to MW thus when there would be an improvement in IEQ there would be improvement in managerial effectiveness and when managerial effectiveness improves, the mental wellbeing improves.

The framework was thus prepared based on the analysis of variables. Personal characteristics viz. age, gender, personality, household composition, management level of the respondents affected the perception of IEQ parameters, managerial environment, and respondent's mental wellbeing. Overall perception about the IEQ parameters

affected the managerial environment of the respondents (I) which again affected the respondent's mental wellbeing (II). It was also noted that gender (III) and management level (VI) of the employees significantly affected perception of IEQ in office spaces (Figure.2).

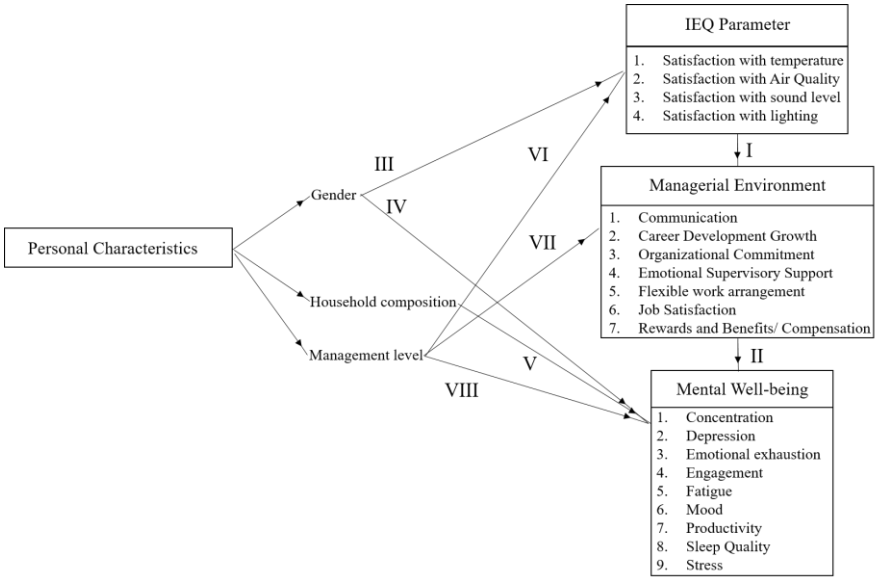

Figure 2: Framework showing relationship among the variables.

Also, managerial environment in the office space gets affected by the management level of the respondents (VII). Lastly, personal characteristics viz. gender (IV), household composition (V) and management level (VIII) of the employees affected the mental wellbeing. Through analysis it was observed that personality and age of the employees did not affect the perception of IEQ, managerial environment and mental wellbeing.

CONCLUSION AND FUTURE SCOPE

Every office has a different type of setting so the perception of the employees towards Indoor Environmental Quality, Managerial Environment and Mental Wellbeing can vary widely. Lean concepts and its principles have been used for providing strategies in terms of recommendation to continuously improve on the mental wellbeing of the employee in the office space by working of their indoor environmental quality and managerial environment. Moreover, more mental health concept can be introduced in the study to get accurate results like building related symptoms (e.g., headache), health status, visual comfort/satisfaction, disorders, phobias. The study can also be extended over a period of one year with more responses. The study was for the population of Ahmedabad, the results can vary for different cities/ states of India based on employee's perception. One can use the results and recommendations of the thesis to optimize the office-based work experience of the employees by improving their indoor environmental quality and their managerial environmental which will improve employee's mental wellbeing. The scope of future work can also be extended by comparing the effect of green buildings on mental wellbeing of employees and that of conventional buildings. Furthermore, future research can include questions related to the work activities done instead of solely categorized based on profession, like being on a call, report typing or processing emails. Having a variable on work activities can lead to more insights, since not each profession is the same but can have overlapping work

activities. In-depth technical study can also be planned with the use of sensors to measure indoor environmental quality parameters. By fast improving technological possibilities and sophisticated data mining techniques, future research will be able to monitor and analyze objective data and subjective experiences with more detail. Thus, the research by its conclusion suggested that lean principles are also applicable in the mental wellbeing context within construction industry.

REFERENCES

Allen, J. G., Macnaughton, P., Satish, U., Santanam, S., Vallarino, J., & Spengler, J. D. (2016). Associations of Cognitive Function Scores with Carbon Dioxide , Ventilation , and Volatile Organic Compound Exposures in Office Workers : A Controlled Exposure Study of Green and Conventional Office Environments. *Environment Health Perspectives*, *124*(6), 805–812.

ANSI/ASHRAE. (2017). *ANSI/ASHRAE Standard 55-2017. Thermal Environmental Conditions for Human Occupancy.* ASHRAE.

Aryee, S., Fields, D., & Luk, V. (1999). Journal of Management. *Journal of Management*, *25*(4), 491–511. https://doi.org/10.1177/014920639902500402

Bubonya, M., & Cobb-clark, D. A. (2017). Mental Health and Productivity at Work: Does What You Do Matter? *Labour Economics*. https://doi.org/10.1016/j.labeco.2017.05.001

Caldwell, J. A., Caldwell, J. L., Thompson, L. A., & Lieberman, H. R. (2019). Fatigue and its management in the workplace. *Neuroscience and Biobehavioral Reviews*, *96*(October 2018), 272–289. https://doi.org/10.1016/j.neubiorev.2018.10.024

Canadian Centre for Occupational Health and Safety. (2017). *Fatigue : OSH Answers*. Government of Canada. https://www.ccohs.ca//oshanswers/psychosocial/fatigue.html

Cobaleda Cordero, A., Babapour, M., & Karlsson, M. A. (2019). Feel well and do well at work: A post-relocation study on the relationships between employee wellbeing and office landscape. *Journal of Corporate Real Estate*, *22*(2), 113–137. https://doi.org/10.1108/JCRE-01-2019-0002

Craft, W., Ding, L., Prasad, D., Partridge, L., & Else, D. (2017). Development of a Regenerative Design Model for Building Retrofits. *Procedia Engineering*, *180*, 658–668. https://doi.org/10.1016/j.proeng.2017.04.225

Eklund, N. H., & Boyce, P. R. (1996). The Development of a Reliable, Valid, and Simple Office Lighting Survey. *Journal of the Illuminating Engineering Society*, *25*(2), 37–41. https://doi.org/10.1080/00994480.1996.10748145

Frontczak, M., & Wargocki, P. (2011). Literature survey on how different factors in fl uence human comfort in indoor environments. *Building and Environment*, *46*(4), 922–937. https://doi.org/10.1016/j.buildenv.2010.10.021

Geng, Y., Ji, W., Lin, B., & Zhu, Y. (2017a). The impact of thermal environment on occupant IEQ perception and productivity. *Building and Environment*. https://doi.org/10.1016/j.buildenv.2017.05.022

Geng, Y., Ji, W., Lin, B., & Zhu, Y. (2017b). The impact of thermal environment on occupant IEQ perception and productivity. *Building and Environment*. https://doi.org/10.1016/j.buildenv.2017.05.022

Horr, Y. al, Arif, M., Kaushik, A., Mazroei, A., Katafygiotou, M., & Elsarrag, E. (2016). Occupant Productivity and Office Indoor Environment Quality: A Review of the

Literature. *Building and Environment*. https://doi.org/10.1016/j.buildenv.2016.06.001

Jensen, P. A., & van der Voordt, T. J. M. (2019). Healthy workplaces: what we know and what else we need to know. *Journal of Corporate Real Estate*, *22*(2), 95–112. https://doi.org/10.1108/JCRE-11-2018-0045

Kim, J., Dear, R. de, Cândido, C., Zhang, H., & Arens, E. (2013). Gender differences in of fi ce occupant perception of indoor environmental quality (IEQ). *Building and Environment*, *70*, 245–256. https://doi.org/10.1016/j.buildenv.2013.08.022

King, N. (1992). Improving the Quality of Working Life through Communication. *International Journal of Quality & Reliability Management*, *9*.

Lapierre, L. M., & Allen, T. D. (2006). Work-Supportive Family , Family-Supportive Supervision , Use of Organizational Benefits , and Problem-Focused Coping : Implications for Work – Family Conflict and Employee Well-Being. *Journal of Occupational Health Psychology*, *11*(2), 169–181. https://doi.org/10.1037/1076-8998.11.2.169

Lowe, G. S., Schellenberg, G., & Shannon, H. S. (2003). Correlates of Employees' Perceptions of a Healthy Work Environment. *American Journal of Health Promotion*, *17*(6), 390–400.

Mujan, I., Anđelković, A. S., Munćan, V., Kljajić, M., & Ružić, D. (2019). Influence of indoor environmental quality on human health and productivity - A review. *Journal of Cleaner Production*, *217*, 646–657. https://doi.org/10.1016/j.jclepro.2019.01.307

Murray, L., Cooper, P., & Hipwell, A. (2003). *Mental health of parents caring for infants*. 71–77. https://doi.org/10.1007/s00737-003-0007-7

Oswald, D., Borg, J., & Sherratt, F. (2019). Mental health in the construction industry: A rapid review. *27th Annual Conference of the International Group for Lean Construction, IGLC 2019*, 1049–1058. https://doi.org/10.24928/2019/0141

Quick, J. C., Macik-Frey, M., & Cooper, G. L. (2007). Managerial dimensions of organizational health: The healthy leader at work. *Journal of Management Studies*, *44*(2), 189–205. https://doi.org/10.1111/j.1467-6486.2007.00684.x

Saks, A. M. (2006). Antecedents and consequences of employee engagement. *Journal of Managerial Psychology*. https://doi.org/10.1108/02683940610690169

Stangor, C., & Walinga, J. (2014). *Introduction to Psychology - 1st Canadian Edition*.

Veitch, J. A., Stokkermans, M. G. M., & Newsham, G. R. (2013). Linking Lighting Appraisals to Work Behaviors. *Environment and Behavior*, *45*(2). https://doi.org/10.1177/0013916511420560

Walton, R. E. (1985). *From Control to Commitment in the Workplace*. Harvard Business Review. https://hbr.org/1985/03/from-control-to-commitment-in-the-workplace

Watson, K. J. (2018). Establishing psychological wellbeing metrics for the built environment. *Building Services Engineering Research and Technology*, *39*(2), 232–243. https://doi.org/10.1177/0143624418754497

WHO. (2004). *Promoting Mental Health: CONCEPTS, EMERGING EVIDENCE, PRACTICE SUMMARY REPORT*. https://www.who.int/mental_health/evidence/en/promoting_mhh.pdf