

**A Thesis Submitted for the Degree of PhD at the University of Warwick**

**Permanent WRAP URL:**

<http://wrap.warwick.ac.uk/156925>

**Copyright and reuse:**

This thesis is made available online and is protected by original copyright.

Please scroll down to view the document itself.

Please refer to the repository record for this item for information to help you to cite it.

Our policy information is available from the repository home page.

For more information, please contact the WRAP Team at: [wrap@warwick.ac.uk](mailto:wrap@warwick.ac.uk)



# **Affect and the Workplace Built Environment**

**by**

**Vibin B. Joseph**

A thesis submitted in fulfilment of the requirements for the degree of

Doctor of Business Administration

Warwick Business School

University of Warwick

September 2020

# Table of Contents

<b>List of Figures</b> .....	<b>VI</b>
<b>List of Tables</b> .....	<b>VII</b>
<b>Abbreviations</b> .....	<b>VIII</b>
<b>Acknowledgements</b> .....	<b>IX</b>
<b>Declaration</b> .....	<b>IX</b>
<b>Abstract</b> .....	<b>XI</b>
<b>1.0 Introduction</b> .....	<b>1</b>
<b>1.1 Purpose of the Research</b> .....	<b>1</b>
1.1.1 Importance of the workplace built environment .....	2
1.1.2 Deconstructing the workplace built environment .....	3
1.1.3 The Problem Statement.....	4
1.1.4 Case for Exploring alternative forms of Eastern architecture .....	5
1.1.5 Project Goal: Answer to my workplace problem .....	6
1.1.6 Brief on Study Conclusion and Contributions .....	7
<b>1.2 Defining core constructs in the study</b> .....	<b>9</b>
1.2.1 Organizational success .....	9
1.2.2 Productivity.....	9
1.2.3 Affect, Moods and Emotions .....	10
<b>1.3 Thesis Structure</b> .....	<b>12</b>
<b>2.0 Literature Review</b> .....	<b>14</b>
<b>2.1 Built Environment Affect</b> .....	<b>14</b>
2.1.1 The Built Environment .....	14
2.1.2 Built Environment and occupant emotions .....	14
2.1.3 Benefits of positive emotions at the workplace .....	15
<b>2.2 The Research Field</b> .....	<b>15</b>
2.2.1 Environmental Psychology – The Evolution.....	16
2.2.1.1 Ambient Factors in the Built Environment .....	18
<b>2.3 Built Environment Design Approach In practice</b> .....	<b>23</b>
2.3.1 Sick Building Syndrome and Environmental Impact .....	24
<b>2.4 Emerging Research Directions in Modern Architecture</b> .....	<b>26</b>
2.4.1 Eco-architecture .....	26
2.4.2 Neuro-architecture .....	26
2.4.2.1 Built Environment factors for affect activation .....	27
2.4.2.2 Optimizing built environment Geometries .....	28
<b>2.5 Positive affect in built environment – Eastern Approaches</b> .....	<b>29</b>
2.5.1 Concept of Energy in Modern Literature .....	30
2.5.2 Eastern view of Energy .....	31
<b>2.6 Vaastu: Background and History</b> .....	<b>32</b>
2.6.1 Background to the principles of Vaastu .....	34

2.6.1.1	Magnetic Poles.....	34
2.6.1.2	Geopathic Zones .....	35
2.6.1.3	Sun Rays and importance of directions .....	36
2.6.1.4	Concentric Square Zones .....	37
2.6.2	Principles of Vaastu Shastra.....	38
2.6.2.1	Humanizing the Built Environment.....	39
2.6.2.2	Guidelines for Spatial orientation, directions, shape, entrances and colors .....	41
2.6.3	Parallels in concepts of Vaastu with emerging built environment research .....	44
2.6.4	Chapter conclusion .....	46
<b>3.0</b>	<b>Methodology Section .....</b>	<b>47</b>
<b>3.1</b>	<b>Research Design.....</b>	<b>47</b>
3.1.1	Description of the Inquiry Process.....	47
3.1.2	Research Inquiry Approach.....	58
3.1.3	Worldview and Research Philosophy.....	59
3.1.4	Research Methodology.....	61
3.1.5	Research Quality .....	62
3.1.5.1	Credibility.....	63
3.1.5.2	Transferability.....	63
3.1.5.3	Dependability.....	64
3.1.5.4	Confirmability .....	64
3.1.6	Researcher positionality .....	65
3.1.7	Source of Funding .....	68
3.1.8	Ethics.....	68
<b>3.2</b>	<b>Pre-Field preparation and planning.....</b>	<b>69</b>
3.2.1	Overview of the Organization .....	69
3.2.1.1	Abbreviated organogram of the organization .....	70
3.2.1.2	Schedule of my interactions with the team prior to field research .....	70
3.2.2	Presentation of the Study approach .....	71
3.2.3	The Study Process .....	72
3.2.3.1	Background to the study - Business Need for constructing the new facility .....	72
3.2.3.2	Meeting with potential Architecture Consultants .....	74
3.2.3.3	Meeting with Vaastu consultants .....	74
3.2.4	Shortlisting the intervention study Building .....	75
3.2.5	Determining Execution Time .....	76
3.2.5.1	Building renovation in the Intervention study.....	76
3.2.5.2	Green field facility in the Developmental study .....	77
3.2.6	Determining duration for data collection in the study .....	77
3.2.7	Controls in the Study .....	79
3.2.7.1	Understanding Confounding variables in the research setting .....	79
3.2.7.2	Importance of controlling workplace built environment variables .....	82
3.2.7.3	Variables in the Built environment - Physical Workplace effects .....	83
<b>3.3</b>	<b>Enquiry Methods .....</b>	<b>83</b>
3.3.1	Entry into the Field .....	83
3.3.1.1	Study Sites.....	83
3.3.1.2	Introduction of the research study to HOD's .....	83
3.3.1.3	Prospective Participant Selection .....	84
3.3.1.4	Pre-work before Participant Briefing to blind the study.....	85

3.3.1.5	Invitation to prospective participants to be part of the study .....	85
3.3.1.6	Consent Forms and participation.....	87
3.3.1.7	Participants in the study .....	87
3.3.1.8	Participant debriefing on research protocol .....	87
3.3.2	Intervention Study .....	88
3.3.2.1	Intervention Study setting .....	88
3.3.2.2	Pre – intervention Data collection .....	88
3.3.2.3	Intervention briefing and scheduling building renovation .....	88
3.3.2.4	Designing the building intervention .....	89
3.3.2.5	Assurance of Controls in the Built environment Intervention Design .....	91
3.3.2.6	Post intervention Data Collection .....	95
3.3.2.7	Summary of the Intervention study and Implementation roadmap .....	95
3.3.3	Developmental Study .....	97
3.3.3.1	Developmental Study Setting .....	100
3.3.3.2	Pre-Developmental Data Collection in the existing old building .....	100
3.3.3.3	Designing the New Building with Integrated Design Framework .....	100
3.3.3.4	Applying Integrated Design Model to new and existing buildings.....	102
3.3.3.5	Post occupancy Data Collection of new Building .....	106
3.3.3.6	Summary of Developmental study and Implementation roadmap .....	106
3.3.4	Data Collection Approach .....	108
3.3.4.1	Measures for mood and emotion .....	110
3.3.4.2	Secondary Data collection .....	111
3.3.4.3	Data Sources in the study .....	112
3.3.5	Data Analysis.....	115
3.3.5.1	Movement from raw data to Insights .....	117
<b>4.0</b>	<b>Study Findings .....</b>	<b>120</b>
<b>4.1</b>	<b>Defining core constructs in the Findings .....</b>	<b>123</b>
4.1.1	Categories – Inclusion Principles .....	124
4.1.2	Definition of codes .....	126
<b>4.2</b>	<b>Snapshot of Intervention study findings (Study 1) .....</b>	<b>130</b>
<b>4.3</b>	<b>Moods and Emotions .....</b>	<b>132</b>
4.3.1	Pre-intervention Affect Landscape .....	132
4.3.1.1	Prevailing Mood state.....	133
4.3.1.2	Prevailing Emotional State.....	134
4.3.2	Post Intervention Affect.....	136
4.3.2.1	Mood State .....	137
4.3.2.2	Emotional state.....	138
4.3.3	Summary of Mood and Emotion Findings in Intervention study.....	140
<b>4.4</b>	<b>Changes to productive behaviors that followed the Intervention .....</b>	<b>143</b>
4.4.1.1	Internal communication within the department.....	143
4.4.1.2	Inter-departmental Interactions.....	145
4.4.1.3	Communication with external stakeholders.....	148
4.4.2	Task Execution traits .....	149
4.4.2.1	Self-rated Goal Attainment.....	149
4.4.2.2	Participation and commitment.....	151
4.4.2.3	Task persistence and self-efficacy.....	154
4.4.3	Decision making .....	155
4.4.4	Pro-social behaviors .....	156

<b>4.5</b>	<b>Changes to success factors affected by Intervention .....</b>	<b>160</b>
4.5.1	Financial Measures .....	160
4.5.2	Customer/Market measures.....	161
4.5.3	Process Measures .....	162
4.5.4	People Measures .....	164
4.5.5	Future Preparation Measures.....	164
4.5.6	Summary of success factors.....	165
<b>4.6</b>	<b>Conclusion of Intervention study findings .....</b>	<b>165</b>
<b>4.7</b>	<b>Developmental study Findings (Study 2) .....</b>	<b>166</b>
4.7.1	Moods and Emotions in Developmental study.....	168
4.7.1.1	Affect landscape in the existing built environment.....	168
4.7.1.2	Affect landscape in the new built environment .....	169
4.7.1.3	Summary of Mood and emotion findings in developmental study .....	172
4.7.2	Changes to productive behaviors in new built environment.....	175
4.7.2.1	Workload coping ability .....	175
4.7.2.2	Preparation time.....	176
4.7.2.3	Creativity.....	176
4.7.2.4	Pro-social behaviors.....	176
4.7.3	Changes to success factors in the new built environment .....	177
4.7.3.1	Process Measures .....	177
4.7.3.2	People Measures .....	178
4.7.4	Conclusion of Developmental study Findings.....	179
<b>5.0</b>	<b>Discussions and Insights .....</b>	<b>180</b>
<b>5.1</b>	<b>Summary of the study intentions .....</b>	<b>180</b>
<b>5.2</b>	<b>Discussion on Intervention findings.....</b>	<b>182</b>
5.2.1	Influence of the Intervention on moods and emotions.....	183
5.2.1.1	Occupant Mood states.....	183
5.2.1.2	Emotional reactions to unfavorable situations within department .....	184
5.2.1.3	Emotional reaction to situations outside the department .....	185
5.2.2	Influence of the intervention on productive behaviors.....	185
5.2.2.1	Communication.....	185
5.2.2.2	Task execution traits .....	186
5.2.2.3	Participation and Commitment .....	187
5.2.2.4	Task persistence and self-efficacy.....	187
5.2.2.5	Decision-making.....	188
5.2.2.6	Pro-social behaviors.....	188
5.2.3	Success factors.....	189
5.2.4	Summary of Intervention study discussion.....	190
<b>5.3</b>	<b>Discussion on Developmental study Findings .....</b>	<b>192</b>
5.3.1	Occupant Mood states.....	192
5.3.2	Emotional reaction to challenging situations within department .....	193
5.3.3	Influence on productive behaviors in new built environment.....	194
5.3.3.1	Workload coping ability .....	194
5.3.3.2	Preparation Time .....	194
5.3.3.3	Creativity.....	195
5.3.3.4	Pro – social behaviors .....	195
5.3.4	Success Factors Discussion .....	196

5.3.5	Conclusion of Developmental study discussion.....	197
<b>5.4</b>	<b>Comparison between Intervention (Study 1) and Developmental (Study 2) findings ....</b>	<b>198</b>
<b>5.5</b>	<b>Summary of the study discussion and its significance.....</b>	<b>204</b>
<b>6.0</b>	<b>Conclusion Chapter.....</b>	<b>207</b>
<b>6.1</b>	<b>Suggestions to contemporary action knowledge praxis.....</b>	<b>207</b>
6.1.1	Built environment as an approach to enhance organizational wellness .....	207
6.1.2	Benefits of humanizing with Eastern architectural practices .....	208
6.1.3	Integrated model for humanizing the built environment.....	209
<b>6.2</b>	<b>Study Contributions to literature and practice .....</b>	<b>210</b>
6.2.1	Contributions to Research .....	210
6.2.2	Contributions to practice: Practical Implications.....	214
<b>6.3</b>	<b>Study Limitations .....</b>	<b>215</b>
6.3.1	Researcher reflection on study findings and discussion .....	215
<b>6.4</b>	<b>Future research suggestions.....</b>	<b>220</b>
6.4.1	Thoughts on improving the intervention study design .....	220
<b>6.5</b>	<b>Conclusion – Final reflections.....</b>	<b>223</b>
Appendix – 1	Research Ethics .....	224
Appendix – 2	Participant Consent and Information form .....	229
Appendix – 3	Participant Daily log .....	231
Appendix – 4	Participant Identifiers and Meeting Schedules .....	232
Appendix – 5	Researcher Daily Journal .....	233
Appendix – 6	Consolidated Participant Daily Log .....	235
Appendix – 7	Data Coding and Thematic Analysis .....	237
Appendix – 8	Task Attainment .....	241
Appendix – 9	Absenteeism levels .....	245
Appendix – 10	Work time duration .....	248
Appendix – 11	Financial Measures .....	251
Appendix – 12	Average Monthly Customer Feedbacks .....	254
Appendix – 13	Process and Performance Measures .....	257
Appendix – 14	Mood state analysis .....	260
Appendix – 15	Process and performance measures in the new built environment .....	263
Appendix – 16	Mood state analysis in the new built environment .....	266
Appendix – 17	Workdays .....	268
Appendix – 18	Compilation of self – reports .....	270
Appendix – 19	Interviews .....	272
Appendix – 20	Monthly Observations .....	275
Appendix – 21	Co-working .....	278
Appendix – 22	Observations .....	280
<b>References</b>	<b>.....</b>	<b>282</b>

# List of Figures

Figure 1.1: Organization of the Thesis .....	13
Figure 2.1: Designing affect activation through elements in the Built Environment .....	27
Figure 2.2: Different geometric forms in built environment cause brain wave pattern changes ...	28
Figure 2.3: Spatial weight distribution according to directions .....	35
Figure 2.4: Humanizing the Built Environment: Analogy to human body through Vaastu .....	40
Figure 2.5: Movement of the Sun as day progresses: Significance of quadrants in building .....	41
Figure 2.6: Positive Energy Flow into the built environment: Positioning the main entrance .....	41
Figure 2.7: Spatial positioning of natural elements in built environment space .....	42
Figure 2.8: Positive Entrances .....	44
Figure 3.1: Depiction of the Research Design .....	52
Figure 3.2: General layout of the existing Organization facility .....	69
Figure 3.3: Abbreviated organogram of the organization .....	70
Figure 3.4: Confounding variables .....	79
Figure 3.5: Organizational Influences .....	80
Figure 3.6: Designing the building intervention .....	90
Figure 3.7: Positioning Developmental study within the research process .....	98
Figure 3.8: Approach to built environment Design with use of research .....	99
Figure 3.9: Architectural drawings of existing and new Production built environments .....	103
Figure 3.10: Data sources processing in the study .....	114
Figure 3.11: The Circumplex Model of Affect .....	115
Figure 3.12: Thematic Analysis: Deductive coding of Affect ... ..	116
Figure 3.15: Data Structure .....	119
Figure 4.1: Snapshot of Intervention study findings ... ..	131
Figure 4.2: % Task completed in a month .....	151
Figure 4.3: Monthly Participant Absenteeism .....	153
Figure 4.4: Average time spent at work .....	153
Figure 4.5: Financial Measures .....	161
Figure 4.6: Customer Feedback .....	162
Figure 4.7: ISO Compliance Ratings .....	163
Figure 4.8: Average Performance Ratings .... ..	163
Figure 4.9: Mood states – Self ratings .....	164
Figure 4.10: Snapshot of Developmental study findings .....	167
Figure 4.11: ISO Compliance Ratings Developmental study .....	178
Figure 4.12: Average performance ratings Developmental study .....	178
Figure 4.13: Mood state – Self ratings Developmental study .....	179

# List of Tables

<b>Table 2.1: Ambient factors in the built environment from existing literature .....</b>	<b>19</b>
<b>Table 2.2: Comparison of the Design concepts .....</b>	<b>45</b>
<b>Table 3.1: Themes on creating workplace built environment for success ....</b>	<b>49</b>
<b>Table 3.2: Overview of the Research Design steps – Intervention study .....</b>	<b>53</b>
<b>Table 3.3: Overview of the Research Design steps – Developmental study .....</b>	<b>54</b>
<b>Table 3.4: Study Duration and participants .....</b>	<b>55</b>
<b>Table 3.5: Research Instruments in the study .....</b>	<b>55</b>
<b>Table 3.6: Overview of the monthly research instruments .....</b>	<b>56</b>
<b>Table 3.7: Overview of workplace observations .....</b>	<b>57</b>
<b>Table 3.8: Summary of research instruments .....</b>	<b>57</b>
<b>Table 3.9: Schedule of my interactions with the team prior to field research .....</b>	<b>70</b>
<b>Table 3.10: Study Timeline .....</b>	<b>71</b>
<b>Table 3.11: Event identifiers .....</b>	<b>71</b>
<b>Table 3.12: Sequence of events with timeline identifiers .....</b>	<b>73</b>
<b>Table 3.13: Analysis of Organizational Influencers .....</b>	<b>81</b>
<b>Table 3.14: Built Environment factors kept constant during the study period .....</b>	<b>92</b>
<b>Table 3.15: Evaluation of built environment descriptors ....</b>	<b>94</b>
<b>Table 3.16: Steps and Tasks in the Intervention study .....</b>	<b>96</b>
<b>Table 3.17: Integrated Design Framework .....</b>	<b>101</b>
<b>Table 3.18: Comparison of Design Framework compliance in existing and new buildings</b>	<b>104</b>
<b>Table 3.19: Steps and Tasks in the Developmental study .....</b>	<b>107</b>
<b>Table 3.20: 1<sup>st</sup> Order concept analysis from primary field data .....</b>	<b>120</b>
<b>Table 3.21: Categories – Inclusion principles .....</b>	<b>124</b>
<b>Table 3.22: Definition of codes .....</b>	<b>126</b>
<b>Table 4.1: Summary of the mood and emotion findings in Intervention study .....</b>	<b>142</b>
<b>Table 4.2: Summary of the mood and emotion findings in Developmental study .....</b>	<b>174</b>
<b>Table 5.1: Design structure matrix – Intervention study .....</b>	<b>183</b>
<b>Table 5.2: Summary of the Intervention study discussion .....</b>	<b>191</b>
<b>Table 5.3: Design structure matrix – Developmental study .....</b>	<b>192</b>
<b>Table 5.4: Summary of the Developmental study discussion .....</b>	<b>197</b>
<b>Table 5.5: Applying Design Framework to pre-intervention factory and training building.</b>	<b>200</b>
<b>Table 5.6: Transition to positive affect state in Intervention and Developmental study .....</b>	<b>202</b>
<b>Table 5.7: Comparison of behaviors between intervention and developmental study .....</b>	<b>203</b>
<b>Table 5.8: Comparison of success factors between Intervention and Developmental study.</b>	<b>203</b>

# Abbreviations

**AIA: American Institute of Architects**

**ASHRAE: American Society of Heating, Refrigerating and Air-conditioning Engineers**

**ASME: American Society of Mechanical Engineers**

**BREEAM: Building Research Establishment Environmental Assessment Method**

**CABE: Commission for Architecture and the Built Environment**

**CEO: Chief Executive Officer**

**CIMO: Context - Intervention - Mechanism - Outcome**

**CRE: Corporate Real Estate**

**dB: Decibel**

**FM: Facilities Management**

**HAPA: High Activation Pleasant Affect**

**HAUA: High Activation Unpleasant Affect**

**HR: Human Resources**

**IMOI: Input - Mediator - Output - Input**

**ISO: International Standards Organization**

**LAPA: Low Activation Pleasant Affect**

**LAUA: Low Activation Unpleasant Affect**

**LEED: Leadership in Environmental and Energy Design**

**lux: Lumen per Square Metre**

**PANAS: Positive and Negative Affect Schedule**

**SBS: Sick Building Syndrome**

# Acknowledgements

I wish to express my heartfelt gratitude and appreciation to my supervisor, Professor Nicos Nicolaou. He inspired me to pursue the idea of this research, realistically guided the approach and invigorated me with suggestions that proved to be invaluable in shaping this thesis. Without his persistent personal support, recommendations for restructuring, diligence in reading and convincingly critiquing my work – this thesis would not have been accomplished. I also thank my supervisor, Professor Chris Beer for emphasizing the academic direction early on in the programme and pertinent questions during discussions.

My gratitude to all participants who gave up their time and contributed to the research process so graciously. I am indebted to several consultants, and the chief consultant who spent substantial time, support and provided me with additional reference materials.

I also wish to thank several academics and my DBA cohort of senior executives at Warwick, who prompted introspection, patiently reasoned out and contributed suggestions with their vast experience – we will advise each other forever.

Despite this well-rounded ecosystem of guidance and support, nothing would have been possible without my family who had to put up with my penchant for being busy always – My father; My mother; My wife Susan; My brother Sarin and so many others. Love you all.

# **Declaration**

This thesis is submitted to the University of Warwick in support of my application for the degree of Doctor of Business Administration. It has been entirely composed by me and has not been previously submitted in any previous application for any degree.

Vibin B. Joseph, June 2020.

# Abstract

This study focuses on the workplace built environment to drive business improvement, and determines its influence on occupant affect, behaviour and business performance in an organization. Extant literature highlights the beneficial effects of humanized built environment parameters on occupant affect and resulting productivity. However, this atomistic approach adopted through fields of environmental psychology and neuroarchitecture have limited impact at a firm level. On the other hand, Eastern architectural practices stipulate holistic design principles for humanizing the built environment. Eastern and modern architectural concepts were thus applied to the organization for a positive environmental influence.

To provide meaningful analysis, this study was organized into two parts – initially a pre-post intervention pilot study was done, to determine occupant employee changes after spatial layout of the existing modern building was modified based on suggestions from Eastern literature. A subsequent pre-post developmental study based on an integrated framework; developed from concepts in environmental psychology and Eastern architectural literature was applied to construct a new green field facility for positive affect.

To gather data on benefits of the intervention, occupant emotional landscape was tracked over a 22-month period through an insider qualitative ethnographic approach. The researcher mapped participant feelings through 9745 participant daily self-reports, enriched situational awareness through 518 hours of regular interviews, and reflected on observations of 513 workdays that included more than 433.5 hours of co-working alongside participants in a real work setting. Emerging themes were then triangulated with organizational secondary data.

Findings from the intervention study and new built environment suggested a change from the existing ‘low energy’ emotional landscape to one of positive affect, improved productive behaviors and increased productivity at the workplace. By drawing from Eastern architectural practices and environmental psychology, this thesis contributes to an integrated design approach for maintaining and creating positive occupant affect in workplace built environments. Real world actionable knowledge gained from this study can assist practitioners while developing workplace strategy for competitive advantage, and organizational researchers when understanding built environments and human emotions.

# 1.0 Introduction

We spend about 87% of our existence in a building environment (Fisher, 2016). Built environments affect behavior, cognition (Brekke, 2016) and exert a psychological impact on occupants (Halpern, 2014). Studies have demonstrated that intangible aspects of architectural spaces influence human wellbeing, levels of satisfaction, moods, ability to focus attention, reduce stress levels and increase task performance (Côté, 2014). By leveraging indications from literature, this study attempts to design and construct a workplace built environment for positive affect and organization success.

## 1.1 Purpose of the Research

I am an entrepreneur and CEO of the organization where the study will take place. The company became operational in 2009 and serves the biopharmaceutical industry with specialized hardware, engineering and microbiological services to manufacture biologics. Over the years, the company had experienced fair growth and needed to expand into a second manufacturing facility. While exploring the options and brainstorming a list of essentials in the facility, I came across the statement,

"We shape our buildings, and afterwards our buildings shape us."

-Winston Churchill, October 28, 1943, speech to Britain's House of Commons while persuading the house to retain the rectangular orientation of the chamber against suggestions to make the chamber semi-circular or horseshoe shaped (UK Parliament Archives).

This thought resonated with Hippocrates who observed two thousand years ago that the built environment influences mood, behavior and wellbeing of its occupants, and Jonas Salk who attributed the success of the polio vaccine development to the time he spent in the inspiring built environment at the Basilica of Assisi (Ruiz, 2015). As impact of the built environment on human functioning became more apparent, Academy of Neuroscience for Architecture was founded in 2003 by the American Institute of Architects at California, to “explore, educate and apply new research on how the environment enhances brain function, form and development through architecture.” The ability of built environments to influence human behavior also captured the attention of popular science magazine Scientific American, which

published an article about the possibility of creating spaces that can positively affect our work and mood, and that can inspire, relax and heal (Anthes, 2009).

Until I became aware of this intangible aspect of the built environment, like most CEOs, my focus was to reduce the cost of investment into the facility while maintaining the need for what can be measured. This prevalent industry assumption - what cannot be quantified in the workplace built environment will be of no value, ignores the possibility for greater value generation through positive engagement with the built environment (Heerwagen, 2000).

There is however increasing evidence that “one-time incremental costs of designing and building optimal facilities can be quickly repaid through operational savings and increased revenue and result in substantial, measurable, and sustainable financial benefits” (Berry et al., 2004). Companies have thus experimented with different building design configurations to gain advantage over competitors (Thirion-Venter, 2012). As it has become important to maintain competitive advantage in a highly competitive global market (Earle, 2003) and as an entrepreneur CEO, I wanted my organization to gain that additional competitive advantage through the workplace built environment. However, my interactions with facility design service providers in India on these lines did not yield any useful design frameworks. Independent management consultants, process experts and mainstream architects were not aware of the ability of built environments to influence occupant behavior and organization success. Contemporary literature on workplace built environments also failed to provide an integrated holistic design model for practice.

It is in this context that I thought of developing a workplace built environment as strategy to create competitive advantage, increase employee happiness and drive organization success based on suggestions from existing literature.

### **1.1.1 Importance of the workplace built environment**

Over the years, several authors have underscored the importance of workplace-built environment in driving performance and organization success. Becker and Steele (1995) states that the performance of an organization as a complex, dynamic, living organism depends on the “successful integration and deployment of not just people and technology but also of time and space” (in Kupritz, 2000). Haynes and Nunnington (2010, p.154) emphasized the importance of workplace built environment in achieving business strategy

and states Gensler (2005), “Working environment has a fundamental impact on recruitment, retention, productivity, and ultimately on the organization’s ability to achieve its business strategy”. Similarly, Steiner (2005) voiced that “Carefully planned and implemented workplace can have a profound impact on the performance of an organization”.

From an economic perspective, workplace is an organization’s second most valuable asset (Becker and Steele, 1995, p.3) and is the second biggest expenditure for most companies after human resource (Haynes, Nunnington and Eccles, 2017, p.299; McCoy, 2005). Leaman and Bordass (1999) guesstimate that gains and losses of up to 15% of turnover can be attributed to the physical work environment. Besides also serving as physical expressions of branding and corporate values (Heerwagen, 2000), physical work environments have been shown to affect job performance and employee behaviors (Vischer, 2007), reduce employee complaints, absenteeism and increase productivity (Clements-Croome, 2017; Roelofsen, 2002), increase employee wellbeing (Huang, Robertson and Chang, 2004) and even improve business results (El-Zeiny, 2012; Mohr, 1996). Several authors have thus emphasized the importance of physical work environment as an integral part of work itself (Chandrasekar, 2011) and as a means to positively inspire workforce, avoid employee disengagement (Pech and Slade, 2006) and increase job satisfaction (Wells, 2000).

### **1.1.2 Deconstructing the workplace built environment**

Leblebici (2012) categorized the workplace environment into physical components such as workplace infrastructure, lighting, and ventilation, and into behavioral components that affect the employee attitude at the workplace. Physical work environment includes the buildings, their interiors, and the surrounding outdoor areas. It encompasses the “layout and appearance of buildings, the arrangement and properties of rooms, characteristics of equipment and furniture, and the associated ambient conditions (sound, light, temperature, air)” (Sundstrom, 1985, p.174 as in Kupritz, 2002).

Behavioral components such as emotional factor contributors within the built environment affect employee productivity more than the physical components (Leblebici, 2012). Physical settings and buildings in a workplace are a bank of sensory experiences that molds employee attitudes (Clements-Croome, 2006). Built environments affect the behavior of its occupants (Elsbach & Pratt, 2007; Allen & Henn, 2007; Bitner, 1992) and act as a catalyst for

supporting or constraining human behavior (Gans, 1968 as in Kupritz 2002). Studies have shown that buildings can give rise to feelings and emotions (Joye, 2015; Leder et al., 2004), influence psychological functioning such as emotional wellness and social behavior (Cooper & Burton, 2014) and impact occupant's long-term health (Joye, 2007). Building architecture triggers responses such as affordances of objects, approach and avoidance by engaging with all five sensory organs (Vartanian et al., 2015).

### **1.1.3 The Problem Statement**

Despite increased interest in understanding human experience in built environments (Coburn et.al, 2017) amongst organizational scholars in the field (Elsbach & Pratt, 2007), creating environment adapted for occupant behaviours is a complex task (Bitner, 1992). Existing research on workplace built environment has focused on psychological emotions evoked by specific physical and environmental attributes in the workplace. Several studies have highlighted the effect of lighting, sound, temperature, humidity, and movement design on human emotions and behavior in the workplace (Reddy, Chakrabarti and Karmakar, 2012). Despite design inspiration to influence behavior (Desmet, 2015), these studies have expanded in isolation without an integrated approach for practice (Brown, Lawrence & Robinson, 2005). Although progress has been made in identifying specific environmental factors that influence human emotions and workplace productivity (Al Horr et al., 2016), our understanding of the impact of built environment design on emotion is limited (Nanda et al., 2013; Eberhard, 2009a). For more than 50 years, researchers across disciplines have sought to comprehend built environment characteristics that impact emotions, behaviors and wellbeing; but robust ecological models that match built environment design attributes with emotional states are not available (Bower et al., 2019).

A review of the existing literature on workplace built environments with a scholarly outlook did not generate the desired holistic understanding to develop a built environment for wellbeing, productivity and productive behaviors. It is only recently that relationship between emotions and built environment architecture has become part of mainstream modern architectural thinking (Pallasmaa, 2016), resulting in limited real world studies for practice to develop the workplace built environment from an insider perspective (Hall et al., 2017; Chynoweth, 2013). So the problem statement – “something that is going wrong” (Ellis and Levy, 2008, p.28) was: contemporary built environment design approaches have limited knowledge and focus in influencing favourable occupant affect and wellbeing.

### **1.1.4 Case for Exploring alternative forms of Eastern architecture**

Pallasmaa (2016) states, “Architects in the modern era have considered ambiences, feelings and moods as something naive, romantic and entertaining instead of regarding such experiences as necessary constituents of environmental quality.” Coburn et.al, (2017) suggests that architects could design emotionally responsive architecture if there was knowledge of the basis for emotions and sensations within buildings. To further this understanding, emerging field of neuro-architecture (Metzger, 2018; Essawy et al., 2014; Eberhard, 2009) that determines brain changes in built environments to justify human behavior changes and environmental psychology have evolved with specific environment cause relationship studies. However, without a holistic theoretical framework for constructing a built environment, these fields are far away from delivering constructive actionable guidelines for practice.

But history has provided us with design philosophies that can regulate behavior in built environments (Desmet, 2015). Modern day scholars have noted positive emotional responses to the presence of water (Pallasmaa, 2016), naturalistic patterns and symmetry in architecture (Joye, 2007; Salingaros, 2007; Alexander, 2002). Presence of water bodies in a built environment is essential to comply with vernacular vedic architecture designs (Patra, 2009) and naturalistic patterns appear throughout global vernacular architecture for positive psychological engagement with buildings (Alexander, 2002). Similar to beliefs in vernacular architecture, research in neuro-architecture supports the view that harmony with nature positively affects our wellbeing, moods and emotions (Ruiz, 2015).

While western architecture emphasizes functionality and utility, Eastern architecture stressed harmony with nature as the cornerstone of building design. For millennia, ancient Eastern construction practices like the Indian vastu shastra and the Chinese feng shui offered concrete guides to creating spatial harmony between built environments and occupants (Patra, 2009; Mak & Thomas Ng, 2005; Yu 1994; Xu 1998). Vedic design principles and concepts enshrined in the five thousand year old text YiJing from which fengshui originated, deliver a set of principles to create harmony between building and humans. Vedic architectural design practices promote emotional health, harmony and success for inhabitants by using natural proportions and orientations that connect human beings with nature (Macomber and James, 2010; Morandi et.al., 2011; Achari, 2016).

Upon implementing these Eastern principles into the built environment, Wah (1998) mentions the sales director of the company stating, “The immediate effect was that employees started to feel much happier, healthier and more productive which led to a rapid growth in business”. Poulston and Bennett (2012) noted a strong relationship between business success and hotels built on feng shui design principles. Heaton (2016) mentions that buildings constructed according to the principles of Vedic architecture promote harmony, business success and happiness for the inhabitants. After adopting vedic architecture, Chakrabarti (2013) mentions a factory owner who stated, “as a result of the changes, the cost of the production increased many fold, but so did its output and income!”

To drive success within their establishments, businessmen in India have increasingly resorted to the adoption of vedic design principles (Chakrabarti, 2013, p.14) because modern architecture practices have failed to address the human element in built environments. By synthesizing and weaving the research advances in contemporary environmental psychology with historic practices in Eastern Vedic literature, I hope to design a workplace built environment for success in my organization.

### **1.1.5 Project Goal: Answer to my workplace problem**

The goal of this project is to explore, understand and determine the possibilities for building a workplace environment designed for organization success and business performance. This study will describe how the organizational performance was affected by establishing a workplace built environment designed for promoting harmony (Pallasmaa, 2016) and success by incorporating suggestions from environmental psychology and Eastern construction design practices (Patra, 2009; Mak & Thomas Ng, 2005) in an organization based in Bangalore, India.

To address the challenge of humanizing the built environment (Preiser, 1983; Herssens and Heylighen, 2007), a change in the built environment orientation based on traditional concepts in vernacular architecture that emphasizes the psychological aspects of built environment as a living organism (Venugopal, 2012) will be initially applied to the existing built environment developed along contemporary Western architectural practice. This will be formulated as an intervention study (study 1). Thereafter, by leveraging knowledge from study 1, a developmental study (study 2) will be designed to construct a new green field built

environment based on an integrated framework of concepts in environmental psychology and Eastern architectural practices. As modern architectural practices focus on optimizing measurable parameters in the building, while ignoring factors on human scaling (Coburn et.al, 2017), it is envisaged that this scheme of two part studies will mitigate business risk and meet the study purpose (see 1.1).

The studies have three objectives:

- 1) To explore any changes in individual moods and team emotions,
- 2) Understand changes in productivity measures, and
- 3) Evaluate financial results and success factors after incorporating changes in built environment orientation.

Insights gained from the study objectives can serve to determine the competitive advantage accrued to an organization as a result of adopting alternative workplace environment built at a higher initial investment (Macomber and James, 2010).

### **1.1.6 Brief on Study Conclusion and Contributions**

The research made positive contributions to the studied organization by enhancing occupant affect, productive behaviors and organization success factors. Positive changes noted in the post intervention study period pointed to the benefits of leveraging Eastern architectural design practices in humanizing the built environment. Consequently, constructing a green field built environment based on the integrated design model served the research purpose by similarly conferring positive occupant benefits. The integrated design model proposed in this thesis and actualized through the developmental study combines Eastern architectural concepts with emergent research directions that focus on the influence of built environment parameters on human affect.

The research process attempted to understand the built environment factors that influence affect and behaviors at the workplace. This was done by reviewing a wide range of literature on Environmental psychology, Neuroarchitecture and Eastern architectural practices. The research design was subsequently articulated, executed and reviewed using a novel longitudinal pre-post case study approach consisting of data collection tools and analysis methods that have not been previously applied in a real world setting. Research quality attributes emphasized in this study ensures that besides addressing the research questions and

benefiting the studied organization, it can also assist other organizations design a workplace built environment for positive affect and improved business performance.

The study outcome generates significance to businesses because substantial economic output in modern economies come from workers based in built environments. Yet none of the modern built environment experts that I engaged with during the design scoping stage, mentioned workforce productivity or human affect unless asked. Similarly, most businesses today fail to recognize built environment design influences on their workers. They often proceed with renovations and built environment establishments based on instincts, functional utility and convenience, often leading to detrimental consequences.

Findings in this study suggest implications for the overall built environment design approach in practice today. Consistent with literature, the research demonstrated significant firm advantages and increase in overall business performance from built environment design. By reviewing the built environment design consequences on individual affect and firm level productivity, this research was able to corroborate a design configuration for successful business outcomes. Thus, it makes notable contributions to literature and practice.

This thesis addressed paucity of real world studies and makes contributions to literature by:

- 1) Comprehensively understanding human experience in a real life built environment with triangulated, longitudinal and ethnographic research approaches not used in a similar context earlier.
- 2) Recognizing the importance of built environment spatial orientation in influencing human affect, a characteristic not yet emphasized in modern mainstream literature.
- 3) Presenting Eastern design concepts for humanizing built environments as a promising new line of enquiry for modern researchers.
- 4) Devising an integrated built environment design model with multifactorial elements for positive affect and addressing the need for a unified affect based design framework.
- 5) Adding case studies to modern Indian built environment literature where sustainability and humanization concepts are rare.

In addition, this thesis counters the widespread notion that built environments serve a mere support function. With a thick description, it makes significant contributions to practice by:

- 1) Highlighting the importance of built environment design in assisting organization competitive advantage and as a means to enhance organizational wellness.
- 2) Providing practitioners with an easy to use workplace built environment humanization checklist for positive affect.
- 3) Introducing an exhaustive analysis of personnel dynamics and traits that chronicles employee affect, attitudes and behaviors at the workplace built environment.

## **1.2 Defining core constructs in the study**

This section deals with defining success and the narrative to productivity as a behavior, with affect, emotions and moods contributing to organizational success within the workplace built environment context.

### **1.2.1 Organizational success**

Defining and measuring organizational success has different viewpoints depending on an individual's subject area of concern. The meaning of success is likely to vary over time as the organization evolves from a start up to an established phase, and across groups such as investors, employees, customers, suppliers and environmental activists (Likierman, 2006). Despite different perspectives on success, much of academic literature seems to find a common ground in measuring success across the domains generalized by Sink (1985) that includes Customer satisfaction and product quality (Christopher, 2007, p.354), Employee wellbeing, Ability to innovate (Christopher, 2007, p.336), Operational efficiency and social responsibility.

Inside companies, the most accepted measure of company success is determined by organizational performance measures such as growth in revenues and profitability measures (Christopher, 2007, p.143). Therefore, measures of success can be summarized into productivity measures involving cost reduction activities i.e. operational efficiency, and value addition activities resulting in increased revenues and better customer relationships (Heerwagen, 2000).

### **1.2.2 Productivity**

Productivity has different definitions in literature, and has largely been referred to as a ratio of total output to total input (Edosomwan, 1995). Dorgan (1994) defined productivity as increased functional and organizational performance. Increased organization performance and productivity can be evaluated through routine operational indices at the workplace that measure more staff output, reduced staff absenteeism, lesser breaks, punctuality in reporting at work and fewer employees leaving early (leblebici, 2012). Soliman and Hartman (1971)

however postulated that, “Productivity is a particular type of behavior within an organization. It may be high, a positive and desirable behavior; or low, a negative and undesirable behavior.” Similarly, Campbell, J. P. (1990) defined performance as a behavior and differentiated performance from outcomes.

Within the workplace built environment, building benefits and contribution to organizational success can be conceptualized through productivity measures encompassing strategic organizational performance focused on financial outcomes and physiological human resource factors affected by the building environment attributes (Heerwagen, 2000, Clements-Croome, 2000, p.130, 137). Productivity and performance can also be subjectively measured through evaluating perceptions and attitudes of employees (Wang and Gianakis, 1999). Hewstone et al., (1997) defined attitude as a response involving cognitive, affective and behavioral components to a group, individual or thing. Attitude formation and social behavior influencing productivity, satisfaction at work or affective appraisal of places is affected by our moods and emotions (Clements-Croome, 2000, p.54). In a workplace environment, evaluating affective states is important as the building attributes and spatial properties have been shown to affect behavior and human emotions (Kaklauskas et al., 2020; Pallasmaa, 2016; Clements-Croome, 2000, p.52).

### **1.2.3 Affect, Moods and Emotions**

As this research focus lies at the emotional intersection between occupants and the workplace built environment, it aims to understand and map affect changes in the workplace. Affect refers to the underlying experience of feeling, mood or emotion (Hogg et al., 2010), and core affect is defined as a non-reflective feeling evident in emotion and mood (Russell and Barrett, 2009). Affect states are often represented through combinations of dimensional models of valence and activation in different degrees (Ekkekakis, 2012). Russell (2003) states that the dimensional perspective of affect alone does not fully account for emotional episodes and suggested the integration of categorical perspectives with dimensional perspectives. The categorical perspectives recognize differences among affective occurrences such as the distinction between emotions and moods (Ekkekakis, 2012). However, differences between mood and emotion is often clouded, with criteria of distinction that varies considerably and represents a conundrum for psychologists who instead refer to the phenomena as affect to avoid addressing the distinction (Beedie et al., 2005). Therefore, concepts of affect, mood

and emotions are frequently used interchangeably in built environment literature (Mouratidis, 2018; Esteky, 2017; Roe, 2008).

Emotions are a physiological response to stimuli in the environment and are means to conveying the individual psychological situation to others (Clare and Parrott, 1991). Emotions play an important role in directing human behavior and in determining the quality of a person's day-to-day functioning. Hence regulation of emotions within the workplace can help managers in organizations (Locke, 1996). Emotions are vague feelings of moods and preferences (Russell and Snodgrass 1987, Zajonc, 1980) and can be broadly classified into basic temperaments - sadness, disgust, anger, fear, surprise, happiness, shame and interest (Izard 1977, Ekman 1972).

Moods on the other hand are longer lasting innate employee emotional states (Ruiz, 2015) that can be generalized into positive and negative moods (Watson & Tellegen, 1985). As buildings prompt sensory experiences in occupants (Keeling et al., 2012; Clements-Croome, 2006), literature has consistently appraised sensory dimensions as mood altering (Mehrabian and Russell, 1974). As such, past studies of workplaces have focused on the effect of built environment dimensions on moods (Cunningham, 1979; Thornington, 1975; Warren and Warrenburg, 1993; Erlichman and Bastone, 1991; Baron, 1990). Organizational scholars have connected moods to outcome variables such as task performance (Brief & Weiss, 2002; Totterdell, 2000). Studies have shown that individuals with happy and positive mood have better task performance compared to individuals with a sad or neutral mood (Hirt, Melton, McDonald, and Harackiewicz 1996; Totterdell, 1999, 2000). Positive mood also enhances helping behavior (George, 1991), interpersonal relations and motivational behaviours within teams (Desmet, 2015; Tsai et al., 2007) contributing to increased productivity. Oswald, Proto and Sgroi (2015) demonstrated an approximate 12% increase in productivity when individuals were made happier (a positive affect, emotion and mood) in experimental settings. They also noted lower levels of productivity with lower levels of happiness. Thus, by leveraging these conceptual understandings, findings in this study will be analyzed through a dimensional model of affect integrated with perspectives based on a distinction between emotion and mood (see chapter 4.0).

## 1.3 Thesis Structure

This thesis is presented in six main chapters (see figure 1.1). Each chapter begins with an introduction to its background and finishes with a summary to highlight the key findings.

Chapter 2 reviews a wide range of literature to identify the impact of built environments on human affect and behaviors, and provides the theoretical basis of the study. The first part of the Chapter considers the provenance and evolution of environment – behavior studies, focus directions in practice and resulting consequences. Emerging research directions have been outlined next, followed by the fundamentals and design framework of Eastern architectural practices.

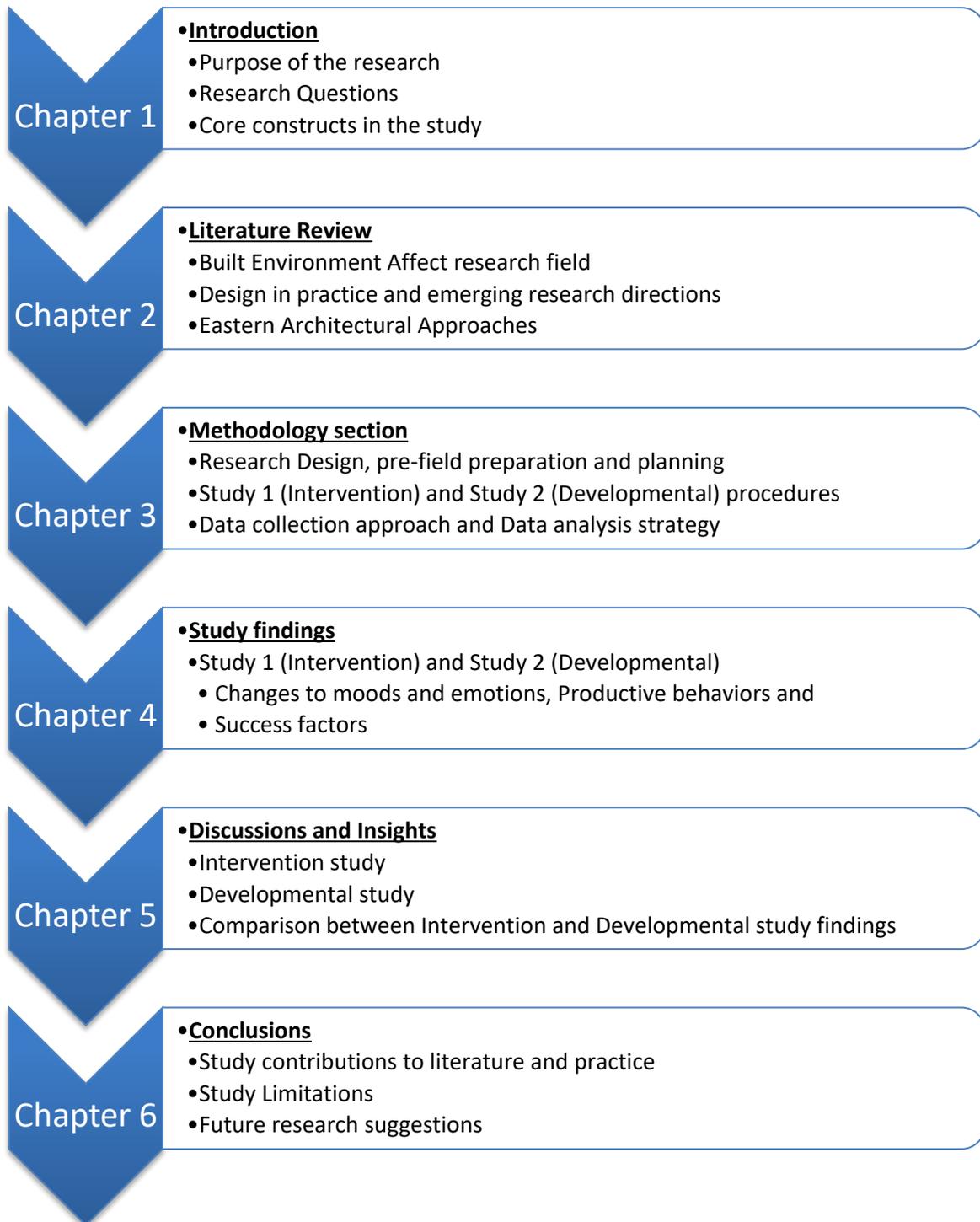
Chapter 3 discusses the research methodology, research design, philosophy and researcher positioning adopted during the study. It then outlines the data collection process and data analysis strategy.

Chapter 4 elaborates on the study findings. They have been categorized into study 1 – Intervention and Study 2 – Developmental, and further organized around research questions explaining changes in affect, productive behaviors and organizational success factors.

Chapter 5 analyzes the findings and rationalizes the observations within the context of literature. Discussion and insights have been categorized into Study 1 and study 2, and organized around themes that emerged from the findings and research questions.

Chapter 6 concludes the study and identifies theoretical contributions, practical implications, study limitations and avenues for further research.

**Figure 1.1: Organization of the Thesis**



## **2.0 Literature Review**

This chapter will synthesize literature sources to provide an analytical overview of knowledge with respect to the research problem being investigated. It will define and position the relevance of the built environment within the context of occupant emotions, elaborate on the research field, explain the current practice and implications, expand on the emerging research directions in modern architecture to address the limitations, explain the Eastern architectural approaches in promoting positive emotions and describe the conceptual basis of the Eastern architectural guidelines.

### **2.1 Built Environment Affect**

This sub-section outlines the impact of built environments on occupant emotions and its significance at the workplace.

#### **2.1.1 The Built Environment**

Halpern (2014) defines built environment as the physical form of specific dwellings and other related aspects of the environment that architects and urban planners study. These environments are constructed for specific social needs and as a result will have a social and physical manifestation. The built environment in the workplace encompasses the entire physical environment devoted for the purposes of accomplishing work. This includes the whole building and consists of workspaces, where an employee sits when in the workplace (Brill and Weidemann, 2001).

#### **2.1.2 Built Environment and occupant emotions**

Several authors have opined on the impact of physical built environment on occupant wellbeing (Galindo and Rodriguez, 2000), satisfaction (Spector, 1997; Judge and Watanabe, 1993; Campbell, Converse and Rogers, 1976), symptoms of depression (Murray and Lopez, 1996; Kohn and Schooler, 1982) and social behaviours & attitudes (Kopec, 2006; Charles et al., 2004). Halpern (2014) stated, “the environment matters...the design have significant and demonstrable effects on the behaviour and well-being of the people who live in them”. Day and Rose (2004) stresses that built environment designs should have virtues of promoting positive moods; maintaining harmony and simplicity; and have balanced proportions with

minimal ambiguities of form, unobtrusive curves and gentle textures. Halpern (2014) indicates that built environments can impact the quality of social relationships and be the reason for relations amongst occupants to turn sour, hostile, lonely and withdrawn. To further explain this perspective, he states, “Environments which encourage and facilitate social contacts will not necessarily lead to positive social relations”. Similarly, Danielsson (2005) notes that better-built environments can have a positive impact on emotional health, wellbeing, psychological attributes, and promote energy, calmness, harmony, efficiency and work accuracy within occupants. Besides the research observations, there is also “a widespread lay belief that the environment around us affects our mental health and well-being” (Halpern, 2014). After a review of architecture literature, Thirion-Venter (2012) concludes that built environments can affect mood and behavior, and exert influence on occupants.

### **2.1.3 Benefits of positive emotions at the workplace**

Employees with positive emotions enjoyed higher productivity, better performance ratings, were more helpful and cooperative, more punctual and enthusiastic, enjoyed positive social relations with others and were less absent at work (Harter et al., 2003; Wright & Staw, 1999; Spector, 1997; Wright & Cropanzano, 2000; Keyes, 1998). In the study of emotional well-being at the workplace, Harter et al., (2003) concluded that positive occupant emotions can increase the opportunity for success and are a dependent component for a “financially and psychologically healthy workplace”.

## **2.2 The Research Field**

While the physical built environment is an important component within the complex work environment landscape (Charles et al., 2004), McCoy (2001) states that “While much research on human behavior in the workplace focuses on social dynamics, comparatively little attention has been paid to the role of the physical environment within the organisation”. According to Halpern (2014), the built environment can be a source of negative moods & emotions and generate secondary sources of stress, but the causal relationship is difficult to establish because of the need for cooperation across several disciplines such as architecture, medicine, sociology and environmental psychology to enhance understanding. Sources of irritation, annoyance, stress and satisfaction are also subtle and thus difficult to identify in the

built environment (Thirion-Venter, 2012). Research on the impact of built environments on occupants therefore lies in the multidisciplinary field of environmental psychology or broadly Environmental Behaviour Science, wherein the main purpose is to “improve quality of life and create better places for people” (Habib, 2010).

### **2.2.1 Environmental Psychology – The Evolution**

It is in the mid twentieth century that Western literature embraced the perspective that inanimate objects have the potential ability to influence human behavior. Barker (1968) was one of the earliest pioneers of environment and behavior studies. He coined the term ‘synomorphy’ to signify that the physical environment and behavior cannot be separated. Environment behavior science studies have a multidisciplinary nature and lies in the fields of architecture, psychology, anthropology, medicine, social geography, ecology, and sociology (Pol and Robson, 1993; Habib, 2010). This interdependent nature is also illustrated by the background of early pioneers in this field such as Alexander Christopher, who was an architect, Robert Sommer and Roger Barker who were psychologists, Edward Hall who happened to be an anthropologist and Kevin Lynch an urban planner (Bechtel, 1997). Riding on the increased research interest, the last twenty years have produced environmental psychology scholars such as D.A.K. Kopec, Juhani Pallasmaa, Omer Akin, John Hall, Susan Rasmussen and Peter Zumthor to name a few.

Environmental behavior studies underline the existence of a reciprocal relationship between the occupants and built environment, where the occupants and environment can affect each other (Habib, 2010). The design of the workplace built environment is shaped by organizational and business needs, human factors, industrial design, engineering needs and the architect’s awareness of environmental psychology aspects (Bechtel and Churchman, 2003). Hence while designing the built environment, designers and architects should consider the impact of the whole design in the context of the greater environment, in addition to incorporating certain beneficial elements within a design (Lidwell, Holden and Butler, 2010). As the design variables interact together (Brebner, 1982), the occupant observer does not break the built environment into smaller elements for analysis but rather appreciates the whole experience together (Theron, 2006). Thus, environmental psychology adopts a holistic analysis to study the situation; embracing behavioral, socio-cultural, neurobiological, cognitive, learning and humanistic perspectives (Kopec, 2006).

Over the last several years, an increasing amount of psychological approaches have been incorporated into workplace built environment design. The field initially progressed with an emphasis on ambient environmental conditions to support productivity; then evolved into positioning the human occupant as part of the built environment design and subsequently matured into design psychology where the occupant sense becomes central to design. Sundstrom & Sundstrom (1986) mentioned that applied psychology concepts were used to determine ambient conditions of light, noise and temperature in a mechanistic model in the pre-Hawthorne era of workplace analysis. In the post Hawthorne era, environment behavior studies focused on Industrial-Organizational psychology and Human Factors Psychology that paid attention to the importance of physical environment, socio-technical systems, person-environment interactions, equipment design and compilation of ambient conditions conducive to work. Sundstrom and Sundstrom (1986) highlighted occupant comfort for efficiency, productivity and accompanying organizational effectiveness, and means to easy communication by increasing physical proximity as the primary factors to be considered in the design of the built environment. In line with these suggestions, environment-behavior studies then progressed to apply a greater focus on ecological and socio-psychological models at an organizational level through environmental psychology. Design psychology concepts were then used to focus on achieving an integrated form of built environment that achieves balance and delights the human senses (Israel, 2003)

Duffy (2014) however describes greater efficiency, enhanced effectiveness and consistent expression as the contributing factors for design considerations in built environments. Western scholars have accordingly taken a mechanistic approach and focused on the measurable attributes in the design of physical workplace built environments. Current workplaces are consequently designed to promote efficiency rather than psychological wellbeing (Handy, 1990; Bain and Taylor, 2000).

### **2.2.1.1 Ambient Factors in the Built Environment**

With a focus on increasing work productivity, workplace satisfaction and sense of workplace belongingness; environmental psychology in the workplace built environment has progressed along three broad typologies that cover physical comfort, functional alignment and psychological factors (Vischer, 2005). Physical comfort includes safety, accessibility and hygiene that are typically met through adherence to building codes (Vischer, 2007). Functional requirements include infrastructure as means to execute work profiles, ergonomic design of workstation/equipment, office layout and furniture arrangements. Psychological factors include ambient environmental elements and degree of environmental choice in the built environment (Vischer, 2007; Gifford, 2014). Ambient environmental conditions comprise of lighting, noise, temperature, humidity and access to natural light in the built environment. Environmental choice discusses the ability to exert control at the workplace and empowerment in decision-making processes through user participation in design.

Therefore, to leverage environmental psychology concepts into an optimum design, psychological and ambient factors that affect transactions between built environment and individuals (Gifford, 2014) have been compiled from across literature sources and tabulated below (See Table 2.1):

**Table 2.1: Ambient factors in the built environment from existing literature**

Ambient Factors	Literature sources	Suggested Levels
Light	<p>Illumination levels have been shown to affect workplace productivity (Bommel et al., 2002). Properly designed lighting system can have a positive and stimulating effect on employees in the work environment (Clements-Croome and Kaluarachchi, 1998). Better industrial lighting has been shown to positively influence task performance, reduce absenteeism and accidents, and improve states of wellbeing (Farhana et al., 2011; Bommel et al., 2002).</p> <p>Sundstrom (1986) indicated an illumination level of about 400 lux to keep people satisfied. However, optimum illumination levels vary across industries, depend on flicker rates, are age related and task dependent. Thus, studies have been inconclusive on the optimum amount of light with Begemann et al., (1997) arguing for an average of 800lux worth of artificial lighting beyond the prevailing daylight contribution in an office environment.</p> <p>Most offices are fitted according to Current office lighting standards for carrying out normal office tasks (Boyce et al., 2003). Indoor lighting levels without day light contributions typically range from 100 to 500 lux depending on the local standards (Bommel et al., 2002). Light flicker of about 50 Hz can cause stress in people (Kuller and Laike, 1998), the effects of which can be negated at high frequencies of around 25 kHz (Wilkins et al., 1989). Lighting levels have also been shown to affect occupant mood and arousal with experiments indicating high light flux densities of 2,800 lux contributing to higher arousal levels (Boyce et al., 1997) and better alertness shown through EEG studies (Kuller and Wetterberg, 1993).</p>	<p>After a review of lighting literature, Bommel et al., (2002) proposed the following criteria for quality lighting:</p> <ul style="list-style-type: none"> <li>• Sufficient light for the task at hand</li> <li>• Uniformity of illumination over the entire task area and throughout the room</li> <li>• Light without flicker and glare</li> </ul>
Noise	<p>Noise at the workplace is a source of reduced productivity and employee discomfort (Mital et al., 1992; Stokols and Scharf, 1990). Studies on noise in the workplace environment have focused on background noise intensities, judgments of employee distractions, speech intelligibility and correlations with physical measures and material properties (Chu and Warnock, 2002; Ayr et al., 2001). Noise in the workplace built environment includes extraneous sources such as equipment noise, street noise and noise from other parts of the building. After a review of noise literature, Jester (2014) concludes that noise is an impediment to work routines and should be reduced to the minimum using sound absorbing materials.</p> <p>Kovrigin and Mikheyev (1965) showed a 25% reduction in productivity at the post room by raising</p>	<p>By compiling regulatory limits on noise pollution across geographies (Barrientos et al., 2004), Farhana et al., (2011) suggests classifying noise exposure as minimum when exposure is less than 85 dB and moderately high when noise exposure is between 85 and 90 dB.</p>

	<p>10 dB in background noise levels. Weston and Adams (1935) showed an increase in productivity in industrial weavers by reducing noise through using earplugs. Kryter (2013) noted an increase in work productivity in the assembly room by reducing noise levels.</p> <p>Noise is also an important occupational risk in industrial environments (Bechtel and Churchman, 2003) and causes hearing loss on continuous exposure (Nanthavanij, 2002). Hence several countries have promulgated rules limiting the exposure to workplace noise (Burgess and Williams, 2006). Current efforts have focused on using sound absorbent surfaces and noise cancelling systems to reduce background noise (Vischer, 2008).</p>	
Temperature	<p>Thermal comfort has been shown to increase workplace productivity, satisfaction and wellbeing. Thermal comfort encompasses temperature, relative humidity and air speed. Vernon and Warner (1932) showed decrease in mechanical work productivity upon raising surrounding ambient temperature. Lorsch and Abdou (1995) proposed a temperature threshold beyond which task productivity reduced. A review of temperature effects on performance by Wyon (1993) showed a reduction in thinking, typing, skill and speed on increasing the ambient temperature. Pepler (1963) noted an average 8% increase in productivity with a five k decrease in temperature.</p> <p>ASHRAE Standard 55-92 is the most widely cited guideline for thermal comfort around the world (Cheng and Ng, 2005). ASHRAE standard 55 -2017 recommends an indoor temperature range between 67 F to 82 F and relative humidity more than 80%. However, ASHRAE standard 62.1 - 2016 had recommended an upper limit of 65% for relative humidity to reduce likelihood of microbial growth.</p> <p>Cheng and Ng (2005) through statistical analysis determined that indoor comfort air temperatures vary from city to city according to local climatic adaption and acclimatization. They determined that a warm and humid city like Hong Kong could have a comfort temperature limit of up to 33.5 degree Celsius if the air speed could be maintained at about 1.5 m/s. They argued for an indoor natural ventilation rate of between 1 to 1.5 m/s for thermal comfort. Similarly, Wijewardane and Jayasinghe (2008) suggested that workers in warm climates could tolerate up to 30 °C without much indoor ventilation. The same survey study concluded that occupant thermal comfort increased to 34 °C on increasing the indoor ventilation rates to 0.6 m/s.</p>	In a warm and humid country, upper temperature limits in the factory could be set at 30 °C (Wijewardane and Jayasinghe, 2008).
Ventilation	After analyzing office workers across several buildings, Raw (1990) concluded that subjects reported a reduction in work productivity with lack of proper ventilation. Holcomb and Pedelty	In a warm and humid country, workplace built environment must

	(1994) and Cyfracki (1990) showed productivity increase and savings on improving the ventilation system. Appropriate air velocity distribution and ventilation is required to maintain a healthy indoor thermal environment (Putra, 2017).	be properly ventilated with sufficient air movement (Cheng and Ng, 2005; Wijewardane and Jayasinghe, 2008).
Furniture	Ergonomically designed furniture will improve employee productivity and facilitate efficient use of space (Van Der Voordt, 2004). Ergonomics of office furniture is an important contributing factor to employee performance (El-Zeiny, 2011). Similarly, ergonomic interventions in the manufacturing industry will reduce time to task completion, enhance employee wellbeing and improve work productivity (Mirka et al., 2002). Non-ergonomically designed office furniture has been shown to have a detrimental effect on employee productivity and wellbeing (Sarode and Shirsath, 2012). Intervention studies demonstrated a 10 to 38% increase in productivity after adoption of ergonomically designed furniture at the workplace (Jensen and van der Voordt, 2016).	Office furniture and worktables should be ergonomically designed and convenient to use.
Space	This includes ease of access to spaces necessary for task execution and its proximity (El-Zeiny, 2011). Clements - Croome (2006) states that depth of space affects human performance possibly due to increasing operational complexity as buildings become bigger. Yet at the same time people do not prefer working in high densities (Katsikakis and Laing, 1993). Densities and space are a tradeoff that needs to be considered from operational practicalities (Clements-Croome, 2006). User surveys have indicated that occupants tend to be dissatisfied with open plan office layouts due to distractions, lack of control and noise levels (Hedge, 1986; Oldham, 1988; Sommer and Steiner, 1988).	As people do not prefer working in high densities, Workstations and factory equipment should be adequately spaced with appropriate number of employees (Katsikakis and Laing, 1993).
Control	Ability to individually control environmental systems and change microclimatic conditions increased workplace productivity by 2.8% according to Kroner (1994) and 9% according to Drake (1990). Both studies noted improved satisfaction as a result of individual environmental control at the workplace.	Sense of individual control over variables in the built environment increase satisfaction and productivity.
Natural Daylight	Clements-Croome (2006) states that lack of natural daylight in a building will make it unpopular amongst office occupiers. He quotes CBPD research and the Dutch Health code that requires windows to be no more than 6m away from any sitting location. Wilkins (1993) reports that daylight can improve efficiency and health. Individuals with window seats are more comfortable (Nicol and Kessler, 1998) and employees prefer more windows in their offices (Nagy et al., 1995). Sunlight exposure through windows has been found to increase worker job satisfaction and feelings of wellbeing (Leather et al., 1998). Though full spectrum fluorescent lighting has been propagated as tool to increase mood and replace natural sunlight, recent studies have however not shown positive	Built environment should have more windows to allow natural daylight into the facility (Leather et al., 1998).

	occupant effects as seen with natural sunlight (Vietsch and McColl, 2001). Sunlight exposure in the office has been found to increase feelings of relaxation (Boubekri et al., 1991) and employee comfort (Aries et al., 2010).	
Indoor Plants	Ulrich (2003) showed that plants and flowers at the workplace improve worker productivity by stimulating innovative thinking. Indoor plants in the workplace have been shown to increase pro social behaviors (Weinstein et al., 2009); promote wellbeing, creativity and productivity (Knight and Haslam, 2010; Smith and Pitt, 2009). Indoor plants also improve physical health (Dingle et al., 2000) and reduce the symptoms of sick building syndrome (Finnegan et al., 1984). Potted plants and pictures of natural sceneries at the workplace have beneficial psychological and physical effects on employees (Bringslimark et al., 2007; Fitzgerald and Danner, 2012). Indoor plants have been shown to reduce formaldehyde, carbon – dioxide and ammonia in the indoor environment (Dingle et al., 2000), improve attention span of employees (Berto, 2005) and reduce their levels of stress, anxiety and blood pressure (Hartig et al., 2003; Kaplan, 1995).	Indoor plants in the built environment increase employee satisfaction, health and pro social behaviors.
Smells and fragrances	Through controlled laboratory studies, Kawakami et al., (1999) concluded that fragrances at the workplace improved concentration and improved task productivity. They also claimed that the kind of fragrances -awakening and sedative amongst others had to be adapted to the kind of work being undertaken. Improvements in work efficiency and positive influences on psychological and physical parameters have been recorded with pleasant odors (Sugano, 1987 in Clements – Croome, 2006).	Pleasant odors in the built environment increase wellbeing and work efficiency.
Color	Color is an ambient stressor and has the ability to affect an individual’s affect, behavior, motivation and social interactions (Peters, 1993; Campbell, 1983). Color of the interior environment has been shown to affect workplace productivity (El-Zeiny, 2011). Studies have shown that the influence of interior colors on worker productivity depends on a combination of the individual’s ability to screen out distractions and exposure time to interior colors (Kwallek et al., 2007). A darker space is perceived as smaller while light colored spaces are perceived as larger (Kwallek et al., 2005). Rooms painted with a cool color tend to be less stimulating than ones painted with warm colors because of the ability of brighter colors to increase activation (Kueller and Mikellides, 1993). White and largely blue-green offices had higher reported satisfaction and job performance rates compared to those in predominantly red offices irrespective of individual distraction screening out abilities (Kwallek et al., 2005). Kwallek et al., (1997) discussed variation in task performances to different colors based on individual distraction screening out capabilities and associated the observation with prevalent levels of individual activation based on Yerkes Dodson principle.	Lighter colors are recommended in the built environment. White and blue green shades have been shown to increase satisfaction and job performance (Kwallek et al., 2005).

As tabulated above, progress has been made in environmental psychology on the understanding of ambient environmental conditions that affect human wellbeing. However, Bluysen (2014) reviews literature and implies that sensory stimulus such as noise, heat, lighting, air quality and thermal comfort interact with each other, and make solutions in the built environment complex. Further adding to the complexity in built environment is the difference between man-made and nature, when Bommel et al., (2002) notes variation in spectral dynamics, wavelength mix and color temperature between natural and artificial sources of light. Thus, there is a lack of complete and holistic understanding on how the built environment affects human emotional health (Villanueva et al., 2013) when Evans and McCoy's (1998) states, "building design has the potential to cause stress and eventually affect human health".

## **2.3 Built Environment Design Approach In practice**

Despite advances in understanding of the impact of built environment on occupants, Smith and Stewart (2006) hold the opinion that environmental psychology concepts are overlooked during the design. Architect's clamor to adhere to the modern and create something new and extraordinary means that "They are trained in architecture school in aesthetics and technology ... the whole human part is left out" (Israel, 2003, p.142). As such "They are interested in whatever is the latest thing and that does not come from within. It's about surface" (Israel, 2003, p.150). More sturdier and taller buildings are constructed today than before (Ali and Moon, 2007). Architects drive to create "something flashy" and "corporate clients, eager for an impressive and noteworthy addition to the skyline, may pay tens of millions of dollars for the architectural equivalent of tail fins. Then the designers go home, feeling artistically gratified, and the client moves in and begins to discover problems" (Obata, 1987). Similar sentiments were also echoed by Stewart in Smith and Stewart (2006) when she described her welcome experience as a first year architectural student, "If there's anyone here who wants to design a building that looks like a Swiss chalet, Greek temple, or Italian villa, you should leave right now. You're here to open your minds and create architecture for the future ..." This approach of creating something radically new appealed to Stewart at the time. But in retrospect she feels that the approach was questionable, as the needs of people remain the same irrespective of the time period. She also argues that there was no understanding on the mechanism of the Italian villa or Victorian house that made occupants feel more

comfortable; to out rightly discard their design philosophies (Smith and Stewart, 2006). Modern architects are also motivated by artistry and prefer asymmetry in designs. But the average person is inspired by convenience and prefers symmetry in designs for the sense of balance that it bestows (Kopeck, 2006, p.51). Most architectural designers have a limited understanding of the impact of architecture on occupant behavior and few attempts to gather data about the users (Brill et al., 1985).

Constructing a built environment is often complex and involves balancing multiple stakeholder interests such as occupant needs, rules of local authorities, interests of developers, financiers, managing agents, perceptions of the passersby (Canter, 1974) and architects and designers (Grey and Tippett, 1992). All these different stakeholders should work in cohesion during the design process to ensure that the needs of the users are met (Cassidy, 2013). However, in practice there is limited, coordinated and unified effort from the different stakeholders to design a built environment optimized for user behavior. The true end users of the built environments are the occupants (Pinder et al., 2003). Despite this importance, users have been accommodated within the modern built environment design process that evolved over the years as described by Keedwell (2009):

- Early modernists ignored occupants and attempted to apply technological advances of the time to the design.
- In the second half of the twentieth century, designer architects generalized user needs into their design but did not succeed in generating a “sense of place”.
- During the late twentieth century, research results in the fields of environmental psychology were applied to whole populations irrespective of group differences.

This modern approach to built environment design along with a focus to reduce costs in built environments (Morris and Dennison, 1995; Lees – Haley, 1993; Matthes, 1992) have resulted in increasing incidences of sick building syndrome (Joshi, 2008) and created environmental sustainability challenges (Kannan and Jani, 2010).

### **2.3.1 Sick Building Syndrome and Environmental Impact**

Bond (2017) in his article on the state of the built environment design mentions, “One of the most notoriously disorientating buildings is the Seattle Central Library, which has won multiple awards for its architecture. Northumbria University’s Dalton, who has studied the building for

several years and has edited a book about it, says she finds it fascinating that a place so universally admired by architects ... can be so dysfunctional”. Bond (2017) goes on to mention a library user’s comment that she had “left the building as soon as I could figure out how to get out, hoping I wouldn’t have an anxiety attack first.”

Thomas-Mobley et al. (2005, p.7) defined sick building as one “in which 20 percent or more building occupants experience acute health effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified.” Moretz (1988) attempted to define a building as sick if building occupants feel unwell and have irritable symptoms that disappear when they go home and reappear on returning back with no identifiable cause. According to Day and Rose (2004), sick building syndrome make occupants feel unwell and produce symptoms such as “headaches, irritability, hyperkinesias, learning disability, fatigue, dermatitis, asthma, rhinitis, flu mimic conditions, and irritations of the bronchia, mucous membranes, throat and eyes which are all easily mistaken for normal ill-health.” Finnegan et al. (1984) also associated occupant lack of concentration, exhaustion, dizziness and nausea with sick building syndrome.

Stolwijk (1991) and The United States National Institute for Safety and Health (Thirion-Venter, 2012) attributes sick building syndrome to inadequate ventilation, contaminations into the built environment such as smoke, gases, pesticides, exhaust fumes drawn into ventilation systems, dust, asphalt, solvents, boiler additives, contaminations from building materials and unknown causes (Thirion-Venter, 2012). However, Thomas-Mobley et al. (2005) suggests that sick building syndrome is caused by complex interactions among psychological, building and environmental factors; and therefore, will require multidimensional solutions to address the issue. Rooley (1997), Matthes (1992) and Clements – Croome (2006, 2017) emphasize the need to address sick building syndrome and have preventive measures in place to have a productive, happy and motivated workforce.

In addition to the effects on occupant health, built environments also contribute to greenhouse effect and are responsible for half of all energy consumption in developed markets (Szalai, 1972; Shorrock & Henderson, 1990). Sustainable practices in buildings are misplaced and guided towards procuring new buildings rather than focusing on maintenance and operations (Sunikka and Boon, 2003). Current efforts have focused towards improving power consumption efficiencies to reduce carbon emissions (Van der Waals, 2001; Lowe, 2000; Sunikka, 2006). Reflecting on the urgent need to adopt sustainability practices in built

environments, The US department of Energy estimates that built environments account for more than two-thirds of all electricity consumption in the US and states, "...traditional building practices often overlook the interrelationships between a building, its components, its surroundings, and its occupants" (Kannan and Jani, 2010).

## **2.4 Emerging Research Directions in Modern Architecture**

Current status of built environments with issues for occupants and concerns for the environment can be hypothesized as a design problem when SimVan der Ryn (2005) states, "In many ways the environmental crisis is a design crisis. It is a consequence of how things are made, buildings are constructed, and landscapes are used." Bechtel and Churchman (2003), and Hartig (2001) postulated the need for an ecological model of built environment design to provide a broader understanding of the impact of built environments on occupant wellbeing and the environment. To address built environment design deficit in current approaches, new streams of architecture methodologies have evolved to understand wellbeing & positive affect in occupants.

### **2.4.1 Eco-architecture**

To create a sustainable built environment, DeKay and Brown (2013) proposed utilizing effects of the sun, wind and light to arrive at design strategies and posit that the energy of natural elements should be leveraged while designing built environments. They advocated a design approach that initially attempts to understand natural energies affecting the built environment, and then devises strategies to gain maximum benefits from them; contributing to occupant wellbeing and built environment operational efficiencies as a result. Similarly, Kellert (2012) suggests using natural energies in a biophilic architectural design to elicit positive experience and occupant wellbeing. Almusaed (2010) articulates energy flows present in a building and suggests that an architect with some experience can create forms that guide wind, water and sun for positive occupant feelings.

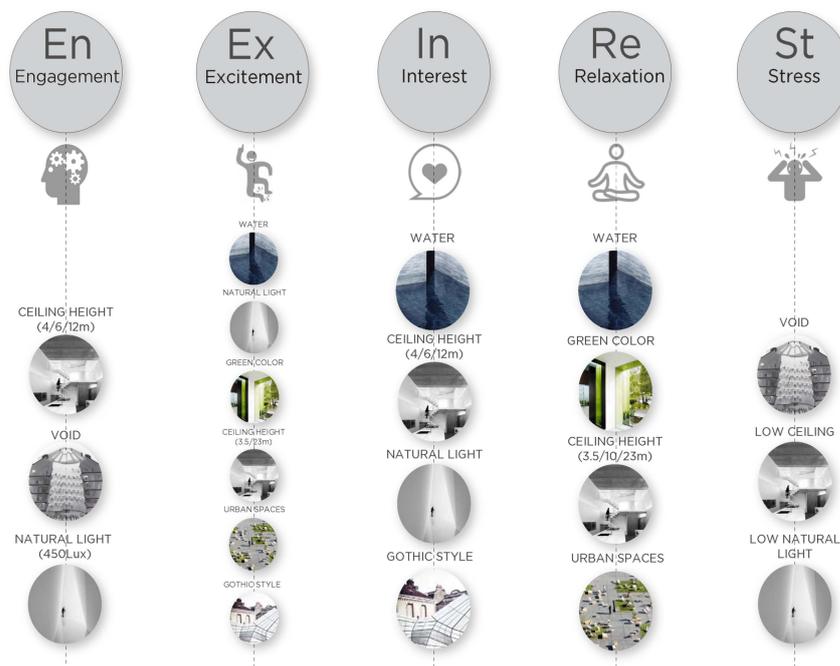
### **2.4.2 Neuro-architecture**

This approach analyses human brain wave changes as a result of built environment factors (Karandinou and Turner, 2017; Essawy et al., 2014). Experiments are traditionally done in

simulated conditions in neurology labs with architecture inputs. The results build knowledge on built environment design parameters and contribute to designing architecture for favorable occupant moods and behavior. Instruments used for scanning the brain include medical diagnostic techniques such as functional MRI, positron emission topography (PET scans), Infra-red spectroscopy, diffusion tensor imaging, electroencephalography (EEG) and magnetoencephalography (MEG).

### 2.4.2.1 Built Environment factors for affect activation

Aoun (2016) from The Institute for Advanced Architecture of Catalonia studied elements in the built environment such as presence of water, ceiling height, natural light, colours and building style. Neuro-architecture methods were then used to correlate the presence of these built environment factors to the activation of attributes such as engagement, excitement, interest, relaxation and stress. The results of the study are depicted below.



**Figure 2.1:** Designing affect activation through elements in the Built Environment.

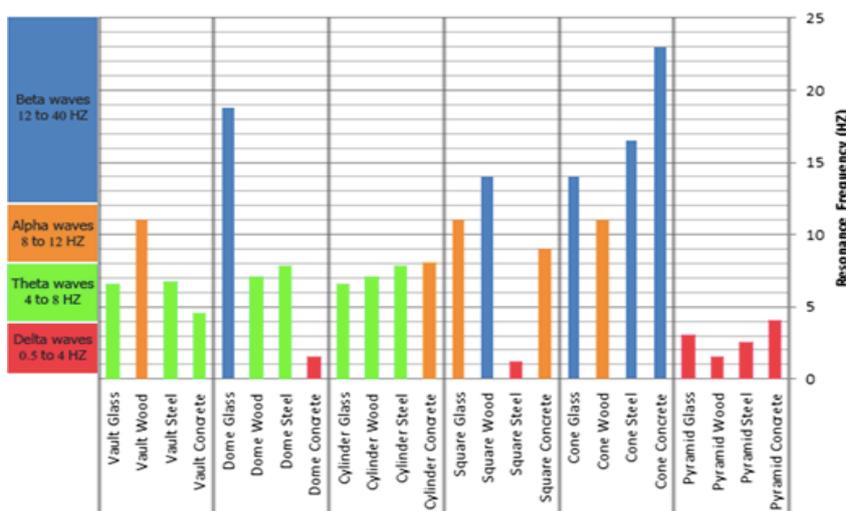
Source: Aoun, 2016

### 2.4.2.2 Optimizing built environment Geometries

Geometries, shapes and material of construction of built environments have been shown to influence the emotions, behavior and health of occupants (Haberakn et al., 2014; Karim, 2010). Shemesh et al., (2015) stated that it is difficult to explain, “How architecture induces them”.

Researchers have attempted to study this phenomenon using sophisticated brain imaging devices such as electroencephalograph (EEG) to study the physiological impact of built environments on human emotional health. Reflecting on research findings and the work of scientists in the field (Vijayalakshmi et al., 2011; Essawy et al., 2014), Elbairoumy, Hegazy and Sheta (2017) states, “Practical experiments which were carried out on a number of buildings’ users indicate a significant change of 70–95% of the users in the electrical activity of their brain after staying for some time inside these buildings.”

After performing electromagnetic computer modeling studies of brain wave patterns of occupants in built environments, Elbairoumy, Hegazy and Sheta (2017) concluded, “It is evident that there are different effects related to the geometric forms and construction materials of the architectural spaces on the users’ brainwaves and consciousness.” The authors noted that different geometric forms and materials of construction resonated with different frequencies, and had different effects on the human brain as shown below.



**Figure 2.2:** Different geometric forms in the built environment cause brain wave pattern changes.

Source: Elbairoumy, Hegazy and Sheta (2017)

These initial studies indicated that favorable affect could be designed by identifying geometric forms and materials of construction – specifically for eliciting psychological states, appropriate for a particular task that the built environment intends to support.

## **2.5 Positive affect in built environment – Eastern Approaches**

On the other hand, Eastern architectural philosophies focus solely on the people and make it the center of their design philosophy. “It teaches that we need to surround ourselves with the energy, balance, and harmony found in nature to lead healthy and productive lives. Its basic premise is that we encounter daily (consciously and subconsciously) hundreds of details that can make us tense and uncomfortable” (Smith and Stewart, 2006). Eastern philosophies do not strive to create dramatic spaces that photograph well but focus on making occupants feel happier and calmer (Smith and Stewart, 2006). This design philosophy begins by appreciating the human need for “nature” and endeavors to create an environment that supports the physical and mental health of the occupants who work and live in the space (Hernandez, 2010; Smith and Stewart, 2006).

As can be noted, the modern approach to environmental management is different from the traditional Eastern approach to built environment design. Steingard et al., (2004) argues that modern scientific approaches adopt a linear approach to achieving specific ends. According to them, this approach is based on partial knowledge and can produce unforeseen side effects as a consequence. They rationalize their point of view by stating, “The whole field on Natural Law is so complex that it is not possible to select any specific law without taking into consideration the total involvement of all the Laws of Nature. All the Laws of Nature are so intimately connected that the isolation of any one law will create imbalance in any field of life”. They therefore advocate a holistic approach to environmental design and management.

Eastern architectural methodology adopts a holistic approach to built environment design with a focus on creating positive effects of the designed environment on occupant’s emotional wellbeing, harmony, happiness, balance and health. Although the basic concept of Eastern architectural approach remains the same across regions (Ludrup, 2013), it is known by different names in different areas (Thirion-Venter, 2012) such as Feng Shui in China, Poony soo jiri in Korea (Hobson, 1994) and vastu shastra in India (Diamond, 2003).

Achieving balance and harmony through energy flow forms the basic foundation of this approach. Eastern architectural approach achieves this by using good design principles that leverage awareness of natural cycles; utilize concepts in space planning, psychology, ecology; and uses common sense (Lagatree, 1997; Diamond, 2003). This approach is the result of cumulative observation by civilizations that surroundings can affect people. This in

a sense makes the Eastern Architectural approach a precursor of Environmental Psychology (Thirion-Venter, 2012). Similar to the present day environmental social science method, early humans “examined weather patterns, interpreted animal behavior, and identified fertile soil ... by doing so they conducted the first environmental studies” (Kopec, 2006, p.3). In ancient forms of architecture and Eastern cultural traditions, energy flow is a fundamental concept (Peterson and Seligman, 2004) that forms the basis for engineering built environment designs.

### **2.5.1 Concept of Energy in Modern Literature**

In Western literature, concept of energy has a preeminent role in psychological and biological theories of the human body (Ryan and Frederick, 1997). In the workplace, energy has just recently emerged as a concept of consideration (Schwartz, 2007; Quinn, 2007; Quinn and Dutton, 2005; Dutton and Ragins, 2017) and has largely revolved around promoting positive psychological states than merely preventing negative attitudes (Luthans and Avolio, 2009). Despite the growing academic interests, Cameron and Dutton (2003) wail that much of existing literature is prescriptive and speculative which can be attributed to the lack of reliable and acceptable measurement devices (Cameron and Caza, 2004; Cameron, 2005). Western literature has seldom defined energy in an organizational context (Quinn and Dutton, 2005) and few organizational scholars have acknowledged the concept as elusive (Cross, Baker and Parker, 2003). Western scholars have traditionally construed energy as an individual psychological phenomenon and defines it as “a type of positive affective arousal, which people can experience as emotion—short responses to specific events—or mood—longer lasting affective states that need not be a response to specific events” (Quinn and Dutton, 2005). Shrager and Shirom (2009) describe cognitive energy, positive affective arousal and physical – behavioral energy as the three forms of human energy. Cole, Bruch and Vogel (2012) broadened this individual construct of energy into a collective energy construct as a shared demonstration of positive affect, agentic behavior and cognitive arousal among employees in pursuit of organization objectives. Positive energy at work is a source of competitive advantage and the “fuel that makes great organizations run,” (Dutton, 2006, p.7). Energy at work creates positivity in organizational behavior to drive superior performance outcomes (Spreitzer and Sonenshein, 2004). This can happen through emotional arousal and positive affect that improves thought efficiency (Fredrickson, 2001), employee creativity (Atwater and Carmeli, 2009), concentration on work tasks and constructive thought processes

(Lykken, 2005), and commitment into realizing organizational purposes (Spreitzer, Sutcliffe, Dutton, Sonenshein, and Grant, 2005).

Western literature has thus viewed energy construct as a human nature that leads to “vigor at work” (Shirom, 2003); a positive attitude that can be achieved through favorable management and human resource practices. During the literature review, I take inspiration from a different view of energy in Eastern literature and apply it through Eastern architectural practices in the built environment. This approach could extend the energy domains identified in Western literature and open a new dimension to support positive behaviors at the workplace.

## **2.5.2 Eastern view of Energy**

Energy is conceptualized as the life force of everything living and inanimate; and is not known in Western philosophical discourse in this manner (Hale and Evans, 2007; Hale, 2000). Like the architectural approach (see 2.5), life energy is known by different names in different areas: as ch'i in China, prana in India and mana in Polynesia. In these cultures, human bodies and Earth are thought to channel life force energy and conceive the universe as being held together by an invisible energy “glue” (O’Connell and Airey, 2005, p.82). From a physical sciences perspective and in modern physics, the natural world is made of particles with atoms, protons and electrons that vibrate at different frequencies. Albert Einstein with his formula  $E = MC^2$  hypothesized that mass (matter) and energy are interchangeable. Carl Jung, the founder of analytical psychology viewed this universal life force energy as an expression of collective consciousness – “a giant reservoir of archetypal energy pattern that we tap into and express symbolically” (O’Connell and Airey, 2005, p.82).

In vastu, feng shui and other forms of Eastern Architectural methodology, the focus is to achieve physical and mental wellbeing through channelizing this energy in the built environment (Hale and Evans, 2007; Hale, 2000). According to these schools of architecture, impact of the built environment on occupant wellbeing depends on the time spent by occupants in built space (Smith and Stewart, 2006). Proponents of these forms of vernacular architecture posit that energy flow through a built space impacts occupant stress and behavior - “All of the energies that surround us, especially those in our physical spaces, reflect how we feel about ourselves and, at the same time, affect our behaviour, often on a subconscious level” (Smith & Stewart, 2006). They reason that when the flow of energy is constrained,

skewed or pinched from flowing freely it results in emotional imbalances and increased stress. They claim that by designing spaces that positively tilts the balance of energies and allows for its free flow, occupants have a greater potential for realizing their full capability as they function in the environment (Smith and Stewart, 2006).

Due to the lack of sufficient understanding in contemporary architecture on means to create an environment that positively influences the emotional wellbeing of occupants (Fazeli and Goodarzi, 2010), I use suggestions from Eastern Architectural methods to design and construct the built environment. While these forms of traditional architecture have similar basic concepts, they also have country specific variations molded by differences in physical conditions, cultural beliefs (Kent, 1993), socio-economic situations and local climatic conditions (Oliver, 1997). To gain an understanding of this field and to incorporate the energy concepts into the intervention study and developmental study, I did a comprehensive literature review of vastu shastra, the variation of Eastern Architectural practice relevant to India, the place of study.

## **2.6 Vaastu: Background and History**

Principles of vastu is a consolidation of the understandings of ancient civilizations “about the universe, its laws, its orders and its analogy to the human body” (Hernandez, 2010). The principles of architectural designs evolved through prolonged esoteric studies of natural energy fields, cosmic aspects and several generations of cumulative observations of the laws of nature (Day and Rose, 2004). They were a response to the surrounding environment and posit that energy fields of the Earth, Sun, Moon and other planetary bodies interact and exert influence on the environment. The focus of vastu shastra is to create built spaces that are in harmony with universal forces and nature (Fazeli and Goodarzi, 2010). Built environment rules for harmony were articulated through the knowledge of Earth’s geology, magnetic energy interactions and direction of the sunrays. This may be one reason that premodern built environment designs were inspired by natural forms, shapes, geometries and symmetry.

Vaastu shastra is one of the ancient few, written traditional architectural guidelines in existence today (Oliver, 1997). Vaastu appeared in the vedic period between 4000 and 2000 BC and was later documented as ‘Sthapatha Vidya’, which means the art of building. Hari (1995) and Bhattacharya (2009) record that nearly 32 books were written on the subject between 3000 BC and 600 AD in the Sanskrit language; with specific guidelines for

architecture - on site selection, placements, construction methods, proportions of built environments and building orientation (Kumar, 2005).

Vaastu traces its origin to the period during the Hindu philosophical discourse and has elements that interrelate to the cultural beliefs dominant then. Ancient societies practiced vaastu in parallel to the religious traditions of the time. This alignment of vaastu with religious practices ensured, “a disciplined pursuit of the building norms” (Chakrabarti, 2013) through codified practices that made transfer of vaastu principles easier to the next generation through a set of rules (Fazeli and Goodarzi, 2010). This mode of practice ensured societal compliance and endurance through history. Origin of vaastu is not religious, but is similar to Yoga (Meditation and health through exercises) and Ayurveda (medicine), fields that holistically connect the laws of nature governing the human body. Therefore, the principles of vaastu are solely based on surrounding environment and laws of nature (Sahasrabudhe and Sahasrabudhe, 2005). Sections of society have erroneously attempted to explain and portray the designs through the lenses of religious beliefs, though the architects of traditional societies had considered many factors into the design including site selection, material, defence, economy, technology and prevailing religious practices of the time. By using environmental, social and economic considerations, they used a multi-faceted, multidimensional approach to built environment design – a possibilistic versus the deterministic approach that can be summarized through the hypothesis of the French geographer Paul Vidal de la Blanche - 'genre de vie' (Johnston et al., 2000).

Krishna (2001, p.141) differentiates vaastu from vastu and states, “As Einstein Proved, everything in existence, sentient and non-sentient, is a field of energy. In this case ‘Vastu’ is referred to pure subtle energy that underlies everything while ‘Vaastu’ is the manifestation or expression of that energy as matter”. The word Vastu is believed to have originated from the Sanskrit word “vas”, which means to reside. It could also have been derived from the word “vasu” which mean Earth; and vastu refers to all the creations above it (Dash and Vasudev, 1998; Ananth, 2001).

Vaastu views built environments as living entities that provide nourishment to occupants rather than an inanimate set up for mere living. Its principles guide built environment design with directions and proportions that favorably influence energy fields for occupant wellbeing. As such in vaastu, the built environment is represented as a microcosm of the universal energy field with a physical human body in coexistence with it (Silverman, 2007).

## **2.6.1 Background to the principles of Vaastu**

Environmental factors such as Sunrays, Magnetic poles, Geopathic zones and concentric zones influenced the formation of vaastu principles (Fazeli and Goodarzi, 2010). The conceptual backgrounds are described as below:

### **2.6.1.1 Magnetic Poles**

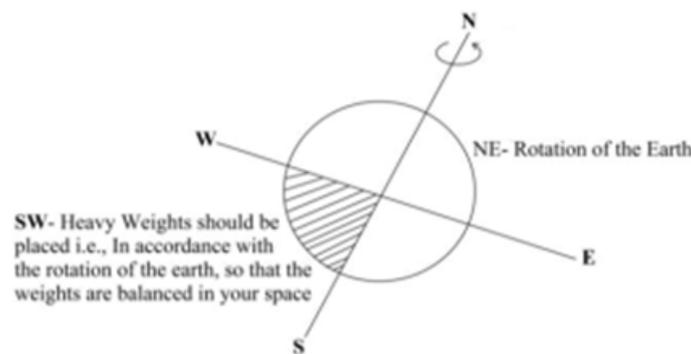
Kumar (2005, p.27) suggests that presence of magnetic energy field of the Earth can be proven, “When a magnetic needle is suspended freely, free from any outer influence, it ends rest along north-south direction of the earth’s magnetic field.” Geologically, Earth has a hot metallic inner core that causes the outer liquid core of the Earth to agitate. This combined with the rotation of the Earth around its axis makes the Earth behave like a geo-dynamo with molten liquid swirling around its axis. Based on the magnetic dynamo theory, the molten metallic core comprising of iron and nickel will conduct electricity and the compressed hydrogen ions in the liquid mantle will move the charges around to generate the Earth’s magnetic field. Due to Earth’s fast spinning rate and based on the dynamo principle – Earth will have a strong magnetic energy field. According to Finlay et al., (2010), Earth’s magnetic field protect us from solar flares. Pulsations in the magnetic field frequently move through the ionosphere and the resulting magnetic disturbances reach the ground, but are hard to detect.

Magnetic lines of flux travel from the North magnetic pole to the South magnetic pole. Thus, the Northern Half of the built environment will have a greater intensity of positive magnetic energy, while the Southern part will be devoid of them (Jiles, 2015, p.8). Inclination of the Earth by 23.5 degrees from its vertical axis causes a deflection in the movement of the flux lines and the resulting concentration in specific areas. Hence, cosmic energy is received and concentrated in the North East and directed towards the South West direction. To stabilize this energy flow pattern, vaastu recommends building shapes, geometries and position of entrances (Krishna, 2001). Since the intensity of cosmic energy becomes weaker as it travels to the South West, vaastu principles recommend that the main entrance into a built environment be constructed in the North East quadrant (see section 2.6.2.1). It is also due to this understanding that vaastu recommends the building to be built along the four cardinal directions – this will align the built environment to the natural flow of energies within the subtle energy grid of the Earth (see section 2.6.1.2) and bring harmonious benefits for the

occupants. To facilitate an uninterrupted flow of natural energy and to maintain a good concentration of cosmic energy in the built environment, vastu principles also advocate that the North East side of the built environment is built lower and lighter compared to the South West direction. Similarly, Vastu principles recommend an ideal plot as one that slopes towards the North or East direction and suggests building roof slope towards the Northern or Eastern direction to make optimum use of the natural energies.

According to vastu, Earth behaves like a living organism that nourishes itself with cosmic energies by tilting on its axis in the North East direction. By following the same environmental principle, vastu conceptualizes the concentration of cosmic energies in the North East direction. This awareness led to the preference for certain directions, orientations and spatial weight distribution guidelines for built environment construction in vastu (Kumar, 2005; Ranjeet et al., 2016).

**Figure 2.3: Spatial weight distribution according to directions**



Source: Ranjeet et al., 2016

### 2.6.1.2 Geopathic Zones

Research by Hacker et al., (2008) highlighted the possible impact of geopathic zones on humans. These aspects are studied in the nascent but emerging field of Geobiology, a field of modern science that studies energy fields. It hypothesizes that an energy grid links the Earth together and it is a web of variables such as magnetism, electricity, colour, light, sound and matter. Bachler and Living (2007) suggests that this energy grid presents through symmetrical geometric patterns creating a matrix similar to human acupuncture points in Chinese medicine. They argue that the study of this energy field led to the evolution of

complex geometrical patterns such as the cube and icosahedrons.

Dr. Manfred Curry hypothesized an energy grid that flows from Northeast to Southwest direction and from Southeast to Northwest direction at a space interval of 3m to 3.5 m. He suggested that for occupants to be healthy and have balance, the built environments should be constructed within the grids away from the crossing points of the energy lines. He reasoned that crossing points of the grid lines have negative energy that are harmful to the human body. Similarly, Dr. Hartmann hypothesized grid lines from North to South and East to West directions, which later came to be known as Hartmann lines with a spacing interval of 2 to 2.5 meters. He also cautioned on the harmful effects to the human body at places where the grid lines cross (Hammer and Von Stuckrad, 2007). Huttunen et al., (2011) attempted to explain the presence of Curry lines and Hartmann lines after analyzing standing radio waves through a spectrometer. Kumar (2005) suggests that by compiling the knowledge of these two grids, vastu scholars had created geometries and squares, with neutral zones of habitation for built environment construction.

An obstruction to the flow of natural energies within the built environment will cause negative energy and “stress clouds” to move into the building (Kumar, 2005). This according to Day and Rose (2004) will create situations similar to Sick Building syndrome as highlighted in modern literature.

### **2.6.1.3 Sun Rays and importance of directions**

Vaastu guidelines prescribe spatial arrangement of different activities in a built environment based on the direction of sun rays. This approach works synergistically with concepts of magnetic energy as mentioned above (see 2.6.1.1). Environmental psychology has often highlighted the importance of natural light as a mood up-lifter for occupants.

The common adage is that the Sun rises in the East and sets in the West. But technically due to the inclination of the Earth on its axis, North East will be the first direction that receives sun rays. Sun light during early mornings have a higher proportion of longer wavelength light rays that have therapeutic benefits. To gain these benefits, vastu advises that the main entrance into the built environment be placed in the North East. Guidelines for more open and lighter North East of a built environment are also to ensure that the built environment receives the maximum amount of healthy natural light.

As the day progresses, the proportion of harmful short wavelength in the natural light

increases and so does the sun rays in the South Easterly direction. Natural Sun light with increasing heat and light intensity flood the South East direction throughout the day and is one reason for the vaastu preference of positioning heat emitting equipment's in this zone. This was to simulate the natural environment and create a microcosm of the natural forces within the built space (Fazeli and Goodarzi, 2010).

On a typical day in the Indian subcontinent, early in the mornings from about 6AM, sunlight has a greater intensity of infrared rays, which is believed to have germicidal and health enhancing properties. From 11 AM to 3PM, the intensity of harmful ultraviolet rays in sunlight is higher. Sunrays tend to be the hottest, when the Sun passes through the South West quadrant during the afternoon hours. This understanding resulted in Vaastu principles advocating placing water sources like wells in the East, North or North East directions to take advantage of the therapeutic properties of morning sunrays. Similarly, to counter the negative effects, the South West regions according to vaastu are to be kept high, heavy and curtained away from sunlight during daytime for occupant comfort (Moossavi, 2016; Sahasrabudhe and Mahatme, 2005; Kumar, 2012; Bryden, 2004; Patra, 2009; Chakrabarti, 2013).

#### **2.6.1.4 Concentric Square Zones**

Silverman (2007) states that ancient cultures advocated the use of square shapes to establish energetic and healthy built environments. Building designs were given variety through the use of concentric squares in ancient Asia, Egypt and Europe. Step pyramids and pagodas were examples of architectural patterns using concentric squares.

According to Marc (1977), vedic teachings advocated square and symmetric geometry for built environments to promote harmony amongst occupants. This is similar to architectural concepts for church and castle designs from Leonardo da Vinci, who illustrated that the geometry of square and circle is in harmony with human proportions as humans can fit harmoniously inside them. The concept of concentric zones was used in ancient Japan, Iran, India and China for built environment design and was suggested as an ideal design method for developing cities by American geographer E.W. Burgess (Pitzl and Pitzl, 2004).

## 2.6.2 Principles of Vaastu Shastra

Based on the conceptual underpinnings (see 2.6.1), the fundamental principles of vaastu are a technically developed elaborate system that provides a blueprint for the development of a built environment (Chakrabarti, 2013). The principles encompass site selection, stages of building construction, measurements, characteristics of building materials and defining the built form through the vastu purusha mandala or master grid for design (Patra, 2009). Although different texts on vaastu present similarities in the layout of building norms, adaptation of vaastu guidelines depend on the region it is applied to with determinants such as local climate, availability of building materials, topography and cultural needs of the society. Thus, despite “a consistent similarity in the layout and classification of its contents”, vaastu principles have to be adapted to suit social and regional variations (Chakrabarti, 2013).

The science of Vaastu aims to maximize the benefits of natural elements and earth’s magnetic field in built environments by stipulating fundamental principles for their design and construction (Patra, 2009). Broad categories that outline this architectural approach are:

- 1) Site planning: Vaastu shastra provides guidelines to identify appropriate sites and correct existing ones for built environment construction. It includes examination of soil, size, shape, color, smell and vegetation. Once the land has been selected, blueprint of the vastu purusha mandala grid (see 2.6.2.1) is superimposed on the plot to facilitate design and proper placement of the elements.
- 2) Orientation: Eight cardinal directions (North, South, West, East, North-East, South-West, North-West and South-East) hold profound significance in vaastu and guide the positioning of activities in the built environment. Vaastu attributes different properties to the cardinal directions based on the direction of the sun and energy rhythms.
- 3) Building with proportionate measurements: This includes guidelines for measurements of height, length, breadth, circumference and thickness to ensure harmony, and to fix and evaluate the frame over which the architectural concept is developed (Chakrabarti, 2013). This domain additionally provides advice for the design of main components in a building such as columns, base, dome, entablature and the roof. These aspects are conceptualized and analyzed with formulas to ensure structural stability and symmetry (Shukla, 1993), similar to the scientific and mechanical means adopted today (Kumar, 2003).
- 4) Aesthetics: Within the above guiding principles, architects are encouraged to focus on

aesthetic beauty with synergistic ornamentation, texture, symmetry, color, granularity and materials that promote harmony to the occupants and visitors. Optimal aesthetics in vastu is often equated to a rhythmical experience like that of listening to poetry (Shukla, 1993).

Vaastu emphasizes the relationship between nature and humans, and works on the fundamental principle that correct placement of various activities in suitable zones will streamline the flow of natural energies and bring in occupant happiness and prosperity (Patra, 2009). As modern architectural techniques have made considerable progress in structural design, strength of materials and stability calculations within the built environment (Macdonald, 2007); this thesis will explain vastu concepts that focus on humanizing the built environment and spatial distribution of activities.

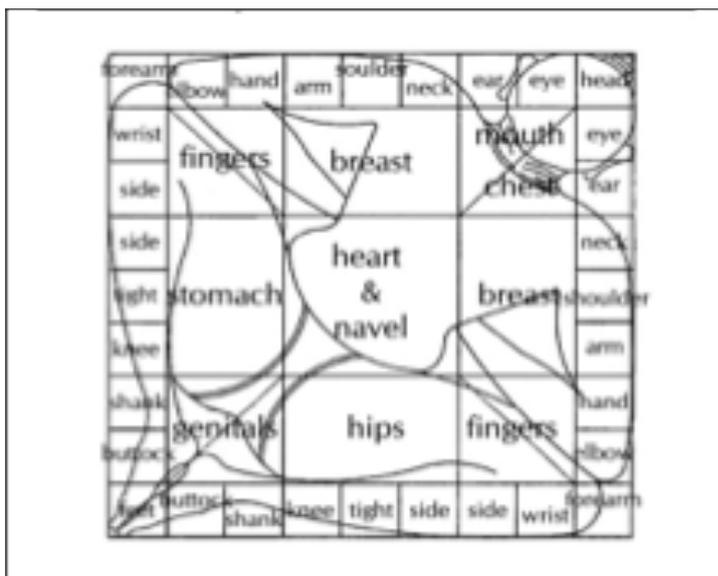
### **2.6.2.1 Humanizing the Built Environment**

Principles of vastu shastra were devised by leveraging awareness and knowledge of the Earth's atmosphere, gravitational force, magnetic field, effect of the wind, sun, moon and other planets on Earth and its living beings. It proposed positioning and spatial arrangement of activities in a built environment to gain positive benefits from energies emitted by the natural and man-made environments. Vaastu shastra sees the design of built environments from the point of view of human habitation. Therefore, wellbeing of occupants is the major focus while designing the built environments and embodies all aspects of a social community life. Unlike modern architecture, it creates artistry and gives form to elicit favorable affective occupant experiences. Due to this innate objective, vastu shastra adopted a holistic approach by combining knowledge of the human body from Ayurveda (traditional field of medicine) and its effect in the context of exposure to universal energy forces, geology, astronomy, material sciences and building engineering. Ayurveda stresses that the human body receives energies in the form of subtle vibrations through channels in the body. Sahasrabhude and Mahatme (2005) refer to Ayurvedic physiologic concepts that divide the human body into zones with vertical, horizontal, diagonal and perpendicular energy axes that are indicative of physical, mental and psychological wellbeing of an individual.

Vaastu shastra aims to balance the energy surrounding the occupant and building by consolidating the understanding of interaction between human body and environment into a diagram of 64 or 81 squares called Vaastu Purusha Mandala (Ananth, 1999). Here, Vaastu refers to matter and built environment; Purusha signifies work power and energy and

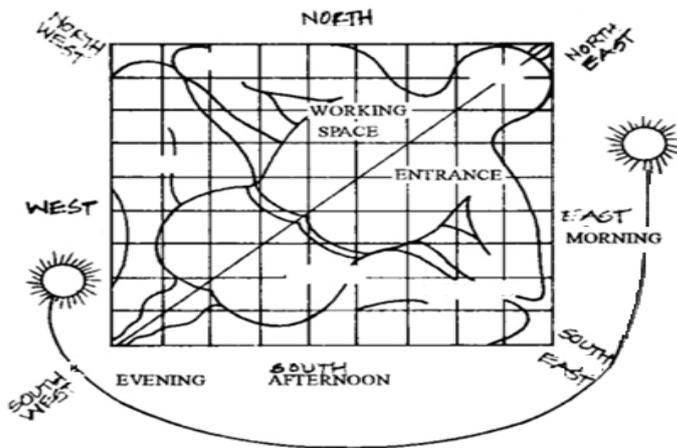
Mandala means diagram. According to vaastu shastra, Vaastu Purusha Mandala represents an ideal spatial orientation that promotes optimum energy in the built environment to support occupant harmony. It is “the representation of the intellectual formation of the building” (Kannan and Jani, 2010). Patra (2009) explains that geometries and patterns of the mandala portray natural phenomena and serve to symbolically represent their influence on the built environment. The pattern and shape of the Mandala take inspiration from environmental factor understandings such as concentric zones, geopathic energy grids, magnetic energy of the Earth and directions, to dictate principles of built environment construction.

To facilitate understanding and easy practice, the built environment is made to resemble a human body through the Vaastu Purusha Mandala. The idea was to design built environment spaces in the same way as a human body. Just as the human body has sensitive zones such as organs, Vaastu recommends that minimum pressure should be exerted in such areas of the built environment. This is achieved by ensuring that heavy structures such as staircases and beams are not constructed and positioned in these sensitive areas. Similarly, heavy structures are also not to be built in the centre of the built environment that corresponds to the navel in the human body, and near the head of the Vaastu Purusha Mandala that corresponds to where the human body breathes. The head region of the mandala corresponds to the North East quadrant of the built environment. Vaastu recommends that these areas are light, open and “filled with windows to serve the similar function” for the built environment (Fazeli and Goodarzi, 2010).



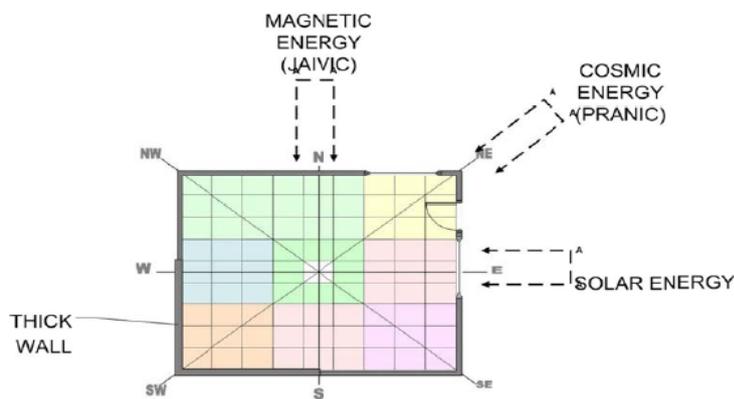
**Figure 2.4:** Humanizing the Built Environment: Analogy to the human body through Vaastu Purusha Mandala

Source: Silverman, 2007



**Figure 2.5:** Movement of the Sun as the day progresses: Hence the significance of quadrants in the building.

Source: Kannan and Jani, 2010



**Figure 2.6:** Positive Energy Flow into the built environment: Positioning the main entrance in the North East Quadrant.

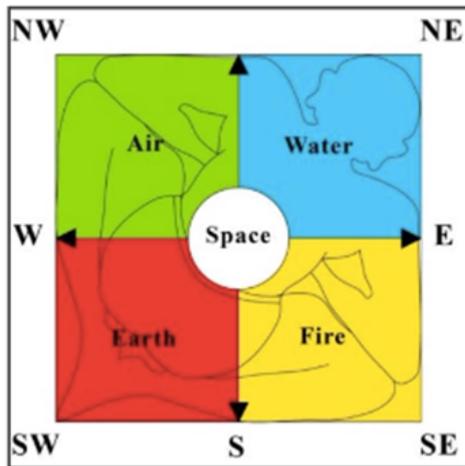
Source: Kannan and Jani, 2013

To design the built environment according to the principles of vastu shastra, geometrical pattern of the Mandala is first applied as a floor plan for spatial orientation; after which patterns, concepts and shapes are created in compliance with it (Fazeli and Goodarzi, 2010).

### 2.6.2.2 Guidelines for Spatial orientation according to Directions, Built Environment shape, position of entrances and colors

Vaastu shastra explains, “how the human body is related to the building and to the universe” (Patra, 2009) with a view that a built environment is a microcosm that should reflect the larger properties within nature, the macrocosm. Just as in nature, the built environment will also include the five elements of water, air, earth, fire and space (Kumar, 2005) that must be spatially arranged to ensure that occupants in the built environment are in sync with nature.

Within the built environment, the Mandala provides assistance in defining the inter-relationship and inter-dependence of different parts with natural elements (Padam, 1998). By summing the knowledge of nature, vaastu shastra suggested the following distribution of natural elements within the built environment landscape (Sui, 2009; Kumar, 2005):



**Figure 2.7:** Spatial positioning of natural elements in built environment space

Source: Sui, 2009; Goodarzi and Fazeli, 2014

Based on the concepts discussed above, vaastu shastra suggests spatial arrangement to reduce occupant stress by positioning sources that produce heat in the southeast quadrant, water in the Northeast quadrant and air sources in the northwest quadrant (Batra et al., 2018). As water modulates the magnetic and gravitational fields together with other natural elements (Alksnis, 2011), appropriate positioning of these elements within the built environment will facilitate flow of natural energies.

Accordingly, Chakrabarti (2013) suggests orientation principles in the factory built environment with North and East side of the factory built environment placed with lighter machineries, heavy machineries positioned towards the south and west direction, heaviest machinery or the main plant in the south west quadrant, heat generating equipment such as boilers and generators in the south east quadrant, and finished goods storage and air compressors in the northwest quadrant. To balance the elements of nature, the outlying factory premises within the larger plot should also adhere to vaastu principles with underground water storage in the northeast corner, staff cafeteria in the southeast quadrant and warehouses built in the northwest quadrant. Similarly, Kumar (2012) outlines a factory layout with

- 1) More space and lighter objects positioned in the North, East and Northeast directions.
- 2) Taller and heavier plants, machineries and heavy raw materials positioned in the

Southern, Western and southwestern sides, with the heaviest and tallest one in the southwestern quadrant.

- 3) Equipment that generates heat such as boilers, generators, ovens, transformers, smoke chimneys and control panels positioned in the southeast.
- 4) Packing, forwarding activities and finished products stored in the northwest.

The importance of spatial weight distribution in the factory built environment was also highlighted by Kumar (2005) and Prasad (2005), when they mention that Southwest should be the heaviest zone in the factory, and all heavy machinery and overhead water tanks if any should be placed in this quadrant.

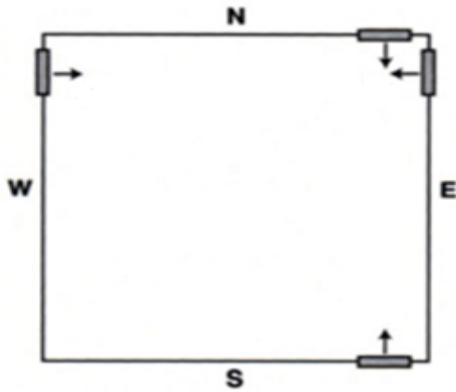
In addition to the spatial arrangement recommendations in the factory built environment, principles in vaastu shastra also emphasize shape and geometry of the built environment, and position of entrances.

### **Shape of the Built Environment**

Like the Vaastu purusha mandala and for ease of spatial positioning, Sharma and Rao (2005) indicate that vaastu shastra principles advocate a square or rectangular geometry for the factory built environment.

### **Position of the Entrances**

Vaastu shastra attaches considerable importance to the position of entrances and recommends that Entrance doors, especially the main one should open towards an auspicious direction (Goodarzi and Fazeli, 2014). The Northeast quadrant of the factory that should be kept light and open is a recommended position for the main entrance into a factory. Main entrance in the North East corner, a positive energy zone according to Sahasrabudhe and Sahasrabudhe (2005) brings in sun and magnetic energy conducive for supporting health and prosperity (Ranjeet et al., 2016; Kumar, 2005). Northeast is also the most auspicious direction in vaastu shastra and it is believed that positive energies enter the built environment from this direction (Goodarzi and Fazeli, 2014). Other secondary entrances can be positioned according to the zone of exalted energies (Sahasrabudhe and Sahasrabudhe, 2005) as shown below (Krishna, 2001, p.109):



**Figure 2.8:** Positive Entrances  
(Adapted from Krishna, 2001)

## Colors

Vaastu shastra opines that colors exert vibrations that affect the body and mind (Krishna, 2001; Arya, 2000; Hari, 1995). Light colors such as white, blue and green are considered to be energy giving that is vital and natural. Red, pink and shades of orange increase agitation, anger, hunger and desires within the body. Brown and black decrease energy of the body (Menen, 2012).

Krishna (2001) suggests that if the above principles of spatial orientation, built environment shape, entrances and colors are adhered to in the workplace built environment design, employees in the workplace will benefit from positive energies.

### 2.6.3 Parallels in concepts of vaastu with emerging built environment research

By analyzing the recent research direction in modern architecture (see section 2.4), it became apparent that techniques to analyze natural energies such as sun movement diagram, wind patterns and season charts proposed by Dekay and Brown (2013) were explained at length in vaastu several millenniums earlier. While emerging architecture fields paid attention to few natural energy domains, vaastu addressed various form of energies from an elementary and conceptual level. Similarly, neuro architecture studies (See section 2.4.2) by Elbaiuomy et al. (2017) and Aoun (2016) have suggested the benefits of adopting specific building geometries, construction materials and presence of built environment elements for evoking positive affect. With increasing conceptual affirmations for vaastu principles through modern analytical tools (see Table 2.2 below), it is ironic that principles of vaastu could not achieve significance within the modern built environment design approach (Kannan and Jani, 2013).

**Table 2.2 Comparison of the Design Concepts**

Vaastu shastra Principles	Confirmation with modern sciences
<p>Built environment shape and geometry: Square or rectangular and symmetry in design</p>	<p>After a review of the vaastu principles, Singh et al., (2011) concluded that there is a close relationship between principles in vaastu shastra and seismic design criteria. According to them, structures designed according to the principle of vaastu shastra have a wider base and increased stability across axes.</p> <p>Elbaiuomy, Hegazy and Sheta (2017) determined through brain imaging studies that spending time in square geometric forms increased brain delta waves that is synonymous with comfort and relaxation.</p> <p>Kopec (2006) and Nasar (1981) suggested that square geometry in built environments decreases the perception of crowding. Environmental psychology suggests the use of symmetry in design with smooth and simple lines to give occupants a positive perception of spaces (Kopec, 2006).</p>
<p>Colors: Different colors have distinctive vibrations and psychological effects.</p>	<p>According to environmental social sciences, different colors exert varied psychological properties such as the use of orange shades in fast food restaurants to make people agitated and feel hungry (Weinschenk, 2011). Environmental behavior studies have shown that colors in the built environment influence behavior, attitude and attention span (Sinofsky and Knirck, 1981), and reduce absenteeism (Papadotas, 1983). Blue and green rooms have shown to yield greater reading comprehension than in red rooms (Mahnke and Mahnke, 1996; Osterberg et al., 1995).</p>
<p>Spatial orientation: North and East directions should be lighter with balancing the natural elements in the built environment.</p>	<p>Kopec (2006) highlighted the art of placement and orientation to create a microclimate, an important concept in Environmental social sciences and environmental psychology.</p> <p>After comparing vaastu principles with Australian livability guidelines, Venugopal (2012) noted similarities with both procedures; suggesting that buildings be oriented along cardinal directions with more open North and East directions to maximize airflow and daylight.</p>
<p>Direction of the Entrance: North, East, Northeast</p>	<p>Shrivastava et al., (2009) cited their study that demonstrated favorable direction specific impact on blood pressure and cortisol levels in humans. According to them, North and East directions showed favorable physiologic profiles compared to the South and West.</p> <p>Similarly, through field data analysis, Travis et al., (2005) suggested physiologic influences, behavior changes and health effects with different built environment orientations.</p>
<p>Contact with natural elements such as sunlight and water in the built environment</p>	<p>Through neuroarchitecture studies, Aoun (2016) showed increased interest and relaxation with the presence of water and natural light. Similarly, to provide for positive functionality and psychological benefits, environmental psychology advocates increased occupant exposure to natural elements (Kopec, 2006).</p>

## **2.6.4 Chapter conclusion**

This chapter on literature review underscored the importance of built environment in moulding occupant emotions and benefits of positive affect at the workplace. Progress in environmental psychology was captured through a systematic literature review and communicated through a list of ambient factors at the workplace. Despite the substantial progress made in understanding of different parameters in the built environment, a gap in the modern architectural practice was established through the increased incidences of sick building syndromes within the built environment context. A review of Eastern architectural sciences revealed guidelines to stimulate positive emotions and harmony in the built environment. Conceptual rationales of the guidelines were explained and a subsequent comparison of the design concepts with modern emergent research directions was made for a fuller understanding of its validity.

## **3.0 Methodology Section**

### **3.1 Research Design**

This section details the techniques and methods chosen to address the research problem.

#### **3.1.1 Description of the Inquiry Process**

The study began with the identification of an ongoing management problem as outlined by the Doctor of Business Administration (DBA) research structure. The increasingly significant DBA (Banerjee and Morley, 2013) emphasizes relevance for practice and encourages starting the workplace research with a live business problem versus a traditional PhD structure that focuses on identifying gaps in literature and current knowledge. The aim of the DBA is to develop “critically reflective practitioners and researching professionals” versus developing “professional researchers” as is the case with the PhD (Hay and Samra-Fredericks, 2016). Once the problem is identified, available relevant literature on the subject is reviewed to frame and solve the problem by combining rigor with a practitioner emphasis (Bourner, Ruggeri-Stevens and Bareham, 2000).

Based on this epistemological position, the problem was framed after 1) Determining an ongoing organizational need of developing a built environment for growth and sustainability. 2) Determining the importance of the workplace built environment to the organization after a review of the existing literature. 3) Scoping interactions with architects and contractors that revealed an absence of knowledge in practice on building a psychologically active workplace for the organization in India. This experience was in line with views from literature that refers to building design as a complex process that cannot be explicitly defined and something where architects use intuition and individual past experiences to create architecture (Michael & Thomas, 2008). Probing consultants on ways to create a productive workplace built environment led to discussions that largely centered around space utilization, fire safety and construction costs (Vaughan, 2013) and functionalistic design (Venturi et al., 2007). This ad hoc building design approach for a productive physical work environment adopted across building design practitioners was merely based on the subjective interpretations of employee work routines (Laing, 2006) and is an unmanaged risk for most organizations (Davis, Leach & Clegg, 2011).

The appropriateness and relevance of this research subject for the DBA was also reaffirmed from literature. Aram and Salipante (2003) suggested that research questions, which develop from implicit knowledge and abstract articulation of experience, have greater prospects of surpassing the academic-practitioner divide. Commenting on the epistemology to be adopted for workplace built environment research that will contribute to practice, Morrell, P. and Duffy, F. (2004) succinctly stated, “An integrated research approach is essential because research in this complex and changing field cannot be conventionally academic.” As such, the theory and practice of building the workplace built environment for organizational success will be the subject of investigation in this study.

Structure of the DBA is similar to action research that focuses on developing valid knowledge for a particular context and covers a large variety of approaches (Van Aken, 2004). The motivation of this research approach is to solve a workplace problem and can be depicted through a problem solving cycle (Van Aken et.al., 2017, p.13). It also shares a paradigm with design science research that has an additional emphasis on demonstrating transferability through a two stage iterative phases of exploration and designing the solution, and testing the solution in multiple contexts through case studies (Van Aken et.al, 2017). Meyer et.al., (2014) explains design science through a five stage process of problem identification, solution design, solution intervention, experimental evaluation and observational evaluation. Similarly, Tanskanen (2017) combines this approach with longitudinal case research and record outcomes through CIMO (context-intervention-mechanism-outcome) logic (Denyer et al., 2008). As such it is a generic process that can be broadly synthesized into Workplace Problem identification, Literature review, Drafting a solution from literature, Implementing the solution and Evaluating the outcome. This approach provides opportunity for shaping the phenomenon of interest (Simon, 2002) with a scholarly research outlook and forms the crux of the DBA. Hence as a practitioner with an ongoing workplace problem, I use this approach to solve the workplace problem and also develop a solution that adds to the body of practical knowledge for practitioners.

The aim of the study is to develop knowledge on building workplace built environment for success and positive affect. Selection of this workplace problem was persuaded by my interactions, understandings and judgment on the need for a new additional facility to support organization growth, in my role as CEO of the company. In addition to finding a solution to my workplace problem, I reasoned that the study subject met the needs of a good research project; is novel, suitable to achieve within my existing circumstances and will be useful to

the business community at large (Balakumar et.al., 2013). Academically, the research project on workplace built environment can contribute to theory and practice in the field of organization research (Ashkanasy, Ayoko & Jehn, 2014).

My quest to build a workplace built environment that can be a source for competitive advantage, and discussions with internal and external stakeholders provided inputs for the initial literature search strategy. These initial concepts were further built through recognized search strategies such as citation pearl growing, brief search and building blocks approach (Rowley and Slack, 2004). These approaches helped to identify the initial concepts that linked workplace built environment with success. This includes understandings that:

- Workplace built environment has physiological and psychological impact on occupants and has the ability to mould human behaviour.
- Human behaviors have been linked to productivity and success.
- Despite emerging evidence on the role of built environment in factors of human scaling, contemporary design practices have minimal attention for these features.
- Vernacular architecture across the world has a firm founding in psychological aspects.
- Adoption of Eastern architectural practices have been associated with business success, positive affect and team behaviors.

Structuring the literature review on these lines yielded subjects of interest in the workplace built environment landscape as environmental psychology, environmental behavior and fields of Eastern building sciences such as vaastu and feng shui. Within these subjects, literature review was filtered to identify the key themes evolving within empirical studies, researcher positions and theoretical models. As success is an output of productivity behaviors within an organization, the common thread pointed towards the effect of workplace built environment on occupant affect and productive behaviors.

**Table 3.1: Themes on creating workplace built environment for success**

Sl. No	Theme
1	Workplace built environment factors that have psychological and physiological impact on occupants, influencing performance and productive behavior.
2	Vernacular architecture design practices for humanizing the built environment
3	Unified design approach between vernacular architecture and concepts in environmental psychology for positive occupant affect and productivity

As understanding of the background situation should be the starting step in the research process (Stake, 2010, p.50), I reflected on the dynamics in the organization. The company serves the global pharmaceutical industry with specialized hardware and microbiological services. It consists of two organizational divisions that operate as independent revenue and operational units – Manufacturing and Training, in a niche knowledge intensive industry domain. The manufacturing division deals with application of engineering sciences, while designing and constructing specialized hardware and automation platforms. The training division focuses on imparting engineering expertise, microbiological knowhow and best practices to the industry and academia. See section 3.2.1 for an overview of the organization.

While I became cognizant of the built environment influence on emotions during my pursuit to design a new manufacturing built environment for success, I also realized from an insider perspective that team cohesiveness, complaints and levels of absenteeism in the training division was intuitively higher than in the manufacturing division. Work effectiveness and creativity were also lackluster, despite having the best employees with doctoral or post graduate degrees as team members and bright market prospects. It seemed odd that those in the training department lost performance, and regained motivation and energy in the manufacturing department. Leadership structure, job responsibilities and internal department governance were discounted as reasons for the decline in performance, as leadership rotation had also not resolved this seemingly pernicious problem. I reasoned that an intervention within the built environment in the training division could be a worthwhile research direction, which if successful can lift team affect and performance. With similar approaches after incorporating principles from literature, Pre and post renovation study in the training department could also serve as the precursor to building a new facility.

Thus, the research project will be executed in two parts.

- 1) Pre and post workplace built environment intervention study in the training department.
- 2) Developmental study (Ahmed et al., 2016, p.270) to build a new manufacturing facility designed for success and positive affect, with a pre-occupancy study in the old built environment and subsequent post-occupancy evaluation in the new built environment.

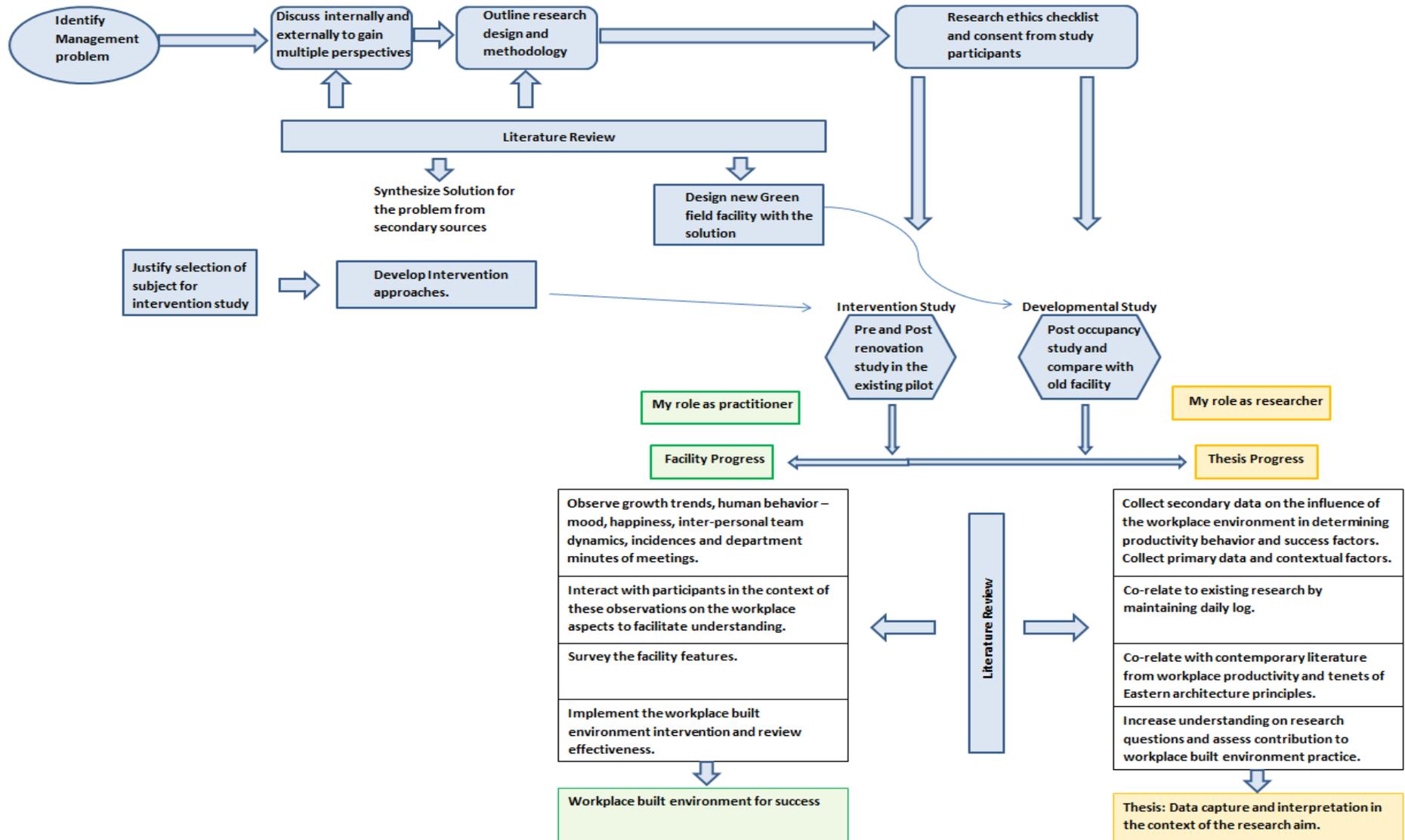
In my journey towards becoming a doctoral researcher, I occupied a space in between practice and research, and endeavored to become “the competent practitioner and the

competent researcher” (Hay and Samra-Fredericks, 2016). To overcome the challenges of this liminal journey, 1) I maintained a daily record of observations, incidences, events, thoughts and experiences in an open and unstructured manner to facilitate reflection. 2) Streamlined my personal work timings with the same responsibilities as earlier 3) Devoted time to research on a daily basis.

After the workplace problem was identified, a scholarly practitioner approach was used to produce actionable knowledge for the larger business world beyond the organization engaged in the research (Aram and Salipante, 2003). Scholarly practitioner approach uses expert advice from professional consultants, current literature within academic or practitioner outlets, business knowledge pertaining to industry specific expertise, social science theory on how people and organizations work and personal experience referring to the internal sense of wisdom (Tenkasi and Hay, 2004).

To generate knowledge on the research questions, I used the research model of Zuber-Skerritt and Fletcher (2015) to guide the research design. This model for quality action research distinguishes between collaborative activities in the fieldwork and thesis writing activities (observing, planning, evaluating) that become contribution to theory and practice. As I am a practitioner engaged in parallel research to address the workplace problem, distinguishing these two fundamental activities will streamline and organize the research approach (see Figure 3.1). Based on this research model, data was collected through research instruments in the study and subsequently reflected on through data analysis. See below tables (3.2 to 3.8) for study duration, number of participants, research instruments in the study and collected data.

**Figure 3.1: Depiction of the Research Design**



**Table 3.2: Overview of the Research Design steps and Sense Making Strategy – Intervention Study**

Study	Data Capture Events	Frequency	Data Records	Data Analysis	Outcomes
<b>Moods and Emotions</b>	Participant feelings, perceptions and self-ratings	Daily	Participant self-reports (Appendix 3)	Deductive, with new codes and categories that will be added inductively to represent data (Appendix 7).	High Activated Pleasant Affect, Low Activated Pleasant Affect, Low Activated Unpleasant Affect, High Activated Unpleasant Affect
	Observation of Smiles, work demeanor and peer interactions	Weekly Monday, Tuesday meetings and daily informal encounters	Researcher Dairy – (Appendix 5)		
	Participant interviews on narratives of self-reports and my observations	Daily, participants will be interviewed in sequence for a weekly account			
<b>Productive Behaviors</b>	Observation of inter-participant behaviors and emotional energy while co-working	Weekly Tuesday, while co-working in the training department	Researcher Dairy – (Appendix 5)	Inductive, Categories and codes that evolved on reading and re-reading data (Appendix 7)	Communication, Task Execution, Decision making and Pro-Social behavior traits
	Participant interviews on narratives of self-reports and my observations	Daily, participants will be interviewed in sequence (Appendix 4) for a weekly account (Appendix 6)			
	Non-participant observations during interactions				
	Productivity factors on Absenteeism,	Monthly	Organization metrics, Self-ratings	Appendix 9	Note Post Intervention differences, determine effect confirmation
	Time spent at work,			Appendix 10	
Self-rated goal attainment	Appendix 8				
<b>Success Factors</b>	Financial measures	Monthly	Organization metrics	Appendix 11	
	Customer measures			Appendix 12	
	Process measures			Appendix 13	
	People measures			Appendix 14	

Discussion of Outcomes with Literature and Conclusion

**Table 3.3: Overview of the Research Design steps and Sense Making Strategy – Developmental Study**

<b>Study</b>	<b>Data Capture Events</b>	<b>Frequency</b>	<b>Data Records</b>	<b>Data Analysis</b>	<b>Outcomes</b>	<b>Discussion of Outcomes with Literature and Conclusion</b>
<b>Moods and Emotions</b>	Participant feelings, perceptions and self-ratings	Daily	Participant self-reports (Appendix 3)	Deductive, with new codes and categories that will be added inductively to represent data. (Appendix 7)	High Activated Pleasant Affect, Low Activated Pleasant Affect, Low Activated Unpleasant Affect, High Activated Unpleasant Affect	
	Observation of Smiles, work demeanor and peer interactions	Weekly Monday, Tuesday meetings and daily informal encounters	Researcher Dairy – (Appendix 5)			
	Participant interviews on narratives of self-reports and my observations	Daily, participants will be interviewed in sequence for a weekly account				
<b>Productive Behaviors</b>	Participant interviews on narratives of self-reports and my observations	Daily, participants will be interviewed in sequence (Appendix 4) for a weekly account (Appendix 6)	Researcher Dairy – (Appendix 5)	Inductive, Categories and codes that evolved on reading and re-reading data (Appendix 7)	Workload coping ability, preparation time, creativity and Pro-Social behavior traits	
	Non-participant observations during interactions					
	Productivity factors on Absenteeism,	Monthly	Organization metrics	Secondary data analysis	Note Post Intervention differences, determine effect confirmation	
	Time spent at work					
<b>Success Factors</b>	Process measures	Monthly	Organization metrics	Appendix 15 Appendix 16		
	People measures					

**Table 3.4: Study Duration and participants**

<b>Intervention Study</b>				<b>Developmental Study</b>			
<b>Data Collection Period</b>	<b>From</b>	<b>To</b>	<b>Workdays</b>	<b>Data Collection Period</b>	<b>From</b>	<b>To</b>	<b>Workdays</b>
Pre-intervention	Friday, 19 January 2018	Monday, 21 May 2018	92	Pre-occupancy	Friday, 19 January 2018	Wednesday, 7 November 2018	221
Renovation phase	Wednesday, 23 May 2018	Sunday, 10 June 2018	15				
Post-intervention	Monday, 11 June 2018	Friday, 31 May 2019	269	Post-occupancy	Monday, 12 November 2018	Friday, 29 November 2019	292
<b>Total Workdays</b>			<b>376</b>	<b>Total Workdays</b>			<b>513</b>
<b>Number of participants in the study</b>			<b>14</b>	<b>Number of participants in the study</b>			<b>9</b>

**Table 3.5: Research Instruments in the study**

<b>Intervention Study</b>						<b>Developmental Study</b>			
<b>Data Collection Period</b>	<b>Self-reports</b>	<b>Interviews</b>	<b>Interview time in Hours</b>	<b>Co-working time in hours</b>	<b>Workplace Observations</b>	<b>Data Collection Period</b>	<b>Self-reports</b>	<b>Interviews</b>	<b>Interview time in Hours</b>
Pre-intervention	1222	160	67.5	106.25	165	Pre-occupancy	1981	345	104.7
Renovation phase	185	29	11.3	22.75	18				
Post-intervention	3740	554	189.6	304.50	362	Post-occupancy	2617	459	144.6
<b>Total</b>	<b>5147</b>	<b>743</b>	<b>268.4</b>	<b>433.50</b>	<b>545</b>	<b>Total</b>	<b>4598</b>	<b>804</b>	<b>249.3</b>

**Table 3.6: Overview of the monthly research instruments**

Year	Month	Workdays	Number of Self-reports		Interview time in Minutes		Co-working time in hours			
			Intervention study	Developmental study	Intervention study	Developmental study	HOD meetings	Training meetings	Department co-working	Total co-working
2018	January	9	123	80	290	300	2	2	7.5	11.5
	February	22	295	196	1230	880	4	4	22.5	30.5
	March	23	306	206	1040	570	4	4	15	23
	April	23	303	207	640	650	5	4	19	28
	May	24	321	215	1120	580	4	4.25	18	26.25
	June	23	316	207	1110	560	4.25	4.75	19.5	28.5
	July	24	335	215	1080	680	5	5	20.5	30.5
	August	24	335	216	1240	540	4	4	15	23
	September	21	294	187	880	540	4	4	16	24
	October	24	334	216	955	780	5	5	22	32
	November	22	308	197	950	800	4	4	16	24
	December	23	322	207	940	820	5	4	11	20
2019	January	23	318	206	1030	680	4.25	4.5	20	28.75
	February	22	305	198	945	710	4	4	14.5	22.50
	March	23	309	206	1010	650	4	4	15.5	23.50
	April	23	306	204	800	780	5	5	21.5	31.50
	May	24	317	216	845	570	4	4	18	26
	June	22	n/a	198	n/a	650	n/a	n/a	n/a	n/a
	July	25	n/a	224	n/a	750	n/a	n/a	n/a	n/a
	August	23	n/a	206	n/a	625	n/a	n/a	n/a	n/a
	September	22	n/a	198	n/a	660	n/a	n/a	n/a	n/a
	October	22	n/a	196	n/a	595	n/a	n/a	n/a	n/a
	November	22	n/a	197	n/a	585	n/a	n/a	n/a	n/a
<b>Total</b>		<b>513</b>	<b>5147</b>	<b>4598</b>	<b>16105</b>	<b>14955</b>	<b>71.50</b>	<b>70.5</b>	<b>291.5</b>	<b>433.50</b>

**Table 3.7: Overview of workplace Observations**

Year	Month	Study phase	Duchenne Smiles	Workplace behaviors	Non-participant observations	Total observations
2018	January	Pre-intervention	2	9	0	11
	February		2	32	0	34
	March		1	67	4	72
	April		3	28	0	31
	May		1	16	0	17
	May	Renovation	1	10	1	12
	June	0	6	0	6	
	June	Post-intervention	4	20	0	24
	July		14	41	0	55
	August		13	24	0	37
	September		14	25	2	41
	October		12	13	4	29
	November		7	17	0	24
December	10		22	2	34	
January	12		16	1	29	
2019	February	5	10	1	16	
	March	9	22	2	33	
	April	11	11	0	22	
	May	10	6	2	18	
	<b>Total</b>			<b>131</b>	<b>395</b>	<b>19</b>

Workdays	513 days	Appendix 17
Self-reports	9745 self-reports	Appendix 18
Interviews	1547 interviews	Appendix 19
Total Interview time	518 hours	Appendix 19
Workplace observations	545 observations	Appendix 20

### 3.1.2 Research Inquiry Approach

Contemporary extant literature on the impact of workplace environment on employee attitudes, productivity and success has made progress in identifying specific environmental factors that influence human emotions and workplace productivity (Al Horr et al., 2016, see Section 2), although academics have voiced concerns on our limited understanding on the subject (Nanda et al., 2013; Eberhard, 2009a). Studies in this field have also tended to silo and expand in isolation within environment psychology, architecture, facilities management and education, fields that are normally outside the usual scope of management sciences and organization behavior (Brown, Lawrence & Robinson, 2005). As a result, no robust models are available to holistically guide built environment design for success and favourable affect (Bower et al., 2019).

After a review of existing literature on workplace built environment and business performance, Morrell and Duffy (2004) in their report to the United Kingdom Commission for Architecture & the Built Environment concluded, “there is certainly a disappointing lack of relevance in most office workplace research to business performance”. Research on the effect of physical work environment on employee attitudes has been largely neglected in literature (Ashkanasy, Ayoko & Jehn, 2014). Despite pertinent research directions within environmental and human psychology (Graham, Gosling, & Travis, 2015), Coburn et al. (2017) states that a “rich tradition of research situated specifically within a psychology of architecture does not exist”. Management scholars and psychologists have rarely studied physical work environment in detail (Chan, Beckman, & Lawrence, 2007) and the subject has often been regarded as a domain for architects (Duffy, 2000). As such experts have noted gaps in current understanding and called for greater research into workplace built environments to understand its impact in molding employee behaviors (Vischer, 2007) and in shaping organization success and competitiveness (Vithayathawornwong, Danko, and Tolbert, 2003).

Although mainstream Western literature has trailed in generating a comprehensive understanding of the holistic impact of workplace architecture on occupant behavior and contribution to organizational success, Vernacular and Eastern literature has underscored the psychological impact of buildings on occupant behavior through an ecological model to guide design. A review of Western literature revealed limited insider studies for practice (Hall et al., 2017; Chynoweth, 2013). The few studies on the impact of vernacular

architecture in management literature have been exploratory in nature and did not yield a benefit for practice (see Poulston and Bennett, 2012). It can thus be concluded that the state of research and prior theory to holistically design a built environment for success and favourable affect is nascent.

After reviewing prior methods research literature, Edmondson and Mcmanus (2007) encouraged qualitative inquiry approach in contexts where prior theory is nascent. They argue that collecting qualitative data can serve to further the understanding of phenomena through pattern identification and thematic content to provide a good methodological fit in such research contexts. As such, Heaton (2016) advocated qualitative research approach while studying the effect of Eastern and vedic architectural practices on the lived experiences of employees and its impact on productivity factors related to the building setting.

Since the aim of this research is to have a workplace built environment designed for success and to understand its impact on the individual and team behaviors; understanding will be developed through a review of routine work performance matrices, interaction with study participants and observations of workplace interactions to determine changes in affect and behaviors. Qualitative approaches are suited for investigating feelings of participants (Yin, 2015, p.137), social relations (Flick, 2014, p.11) and group behaviours in a natural setting (Denzin and Lincoln, 2011, p.373). Adopting a qualitative approach will capture data that meets the practitioner preference for a rich description of the study in words and also improves trustworthiness (Merriam and Tisdell, 2015, p.238). They go on to mention that, “the qualitative study describes people acting in events” and provide sufficient detail to show that the study conclusion “makes sense”. As the study will be conducted in the workplace environment, a qualitative approach will provide me the freedom to involve and guide the research situation (Evered and Louis, 1981).

### **3.1.3 Worldview and Research Philosophy**

By determining the relevant methodological fit and subsequently embracing a qualitative approach for this study, the study design agrees to the underlying four philosophical assumptions outlined by Creswell (2012, p.38) and indicated below:

Ontologically, researchers appreciate multiple realities from the experiences and perspectives of different individuals. Epistemologically, researchers get as close to the study participants

as possible through research conducted in the field and assemble individual views into subjective evidence. Axiologically, the researcher will highlight ethics and values in the study, and report biases in addition to information gathered from the field. Methodologically, the researcher will organize data inductively and derive categories and themes in a bottom up approach with an emergent research design, wherein initial plan for research cannot be prescribed. Additionally, researchers should position themselves in the study as a key instrument, with realities shaped by the experience and background of the researcher in addition to participant meanings.

As this study looks at individual and group behaviors in the workplace built environment, participants in the study can espouse multiple realities of the situation with different interpretations and understanding of the pre and post intervention situation. Consequently, the study posits that reality is relative (Denzin and Lincoln, 2011, p.101). Sense making through observing and analyzing behaviors within the context of participant beliefs, and my interpretations as the researcher, will yield a rich understanding of the psychological effects of the workplace built environment. To reduce distance between participants and myself, and to increase reciprocity, I become an insider researcher. I embody a sense of humility in interactions and adopt a collaborative approach. This fosters an environment of mutually beneficial, “teaching and learning the world together” (Denzin and Lincoln, 2011, p.159).

Since objective of this study is to gain an understanding of the world in which we work through multiple perspectives and meanings, the worldview of this study is constructivism (Creswell, 2012, p.24). Therefore, generation of understanding requires analysis of data under interpretive theoretical perspective, with criteria that are not rules but values that influence judgements (Given, 2008, p.461). Open ended and neutral questions will be used to understand the meanings and evaluations constructed by participants through coding and identification of common themes (Given, 2008, p.556, 88). To develop meaning of the experiences, there will be constant interactions between the researcher and the participants based on the constructivist – interpretive research paradigm.

“The constructivist paradigm assumes a relativist ontology (there are multiple realities), a subjectivist epistemology (knower and responder co-create understandings), and a naturalistic (in the natural world) set of methodological procedures” (Denzin and Lincoln, 2011, p.13). I will then use my experience and existing literature to inductively interpret the data and form a rich description (Merriam and Tisdell, 2015, p.257) of the changes in attitudes and behaviors

as a result of the built environment intervention. I recognize the potential influence of my views and experience in interpreting this data. So, I will report assumptions and possible biases while interpreting and reporting information from the field study. The study thereby adopts a nonfoundational approach (Amis and Silk, 2007), which postulates that relativism is inevitable, that all knowledge is value laden, and that intention based on ethics and morality is fundamental to the study purpose and research quality.

### **3.1.4 Research Methodology**

For the study of the workplace built environment and business performance, CABA (2005) states that “An integrated research approach is essential” as no one discipline can identify how the complex nature of built environment impacts business performance. Due to the interdisciplinary nature of the built environment, CABA (2005) emphasizes an understanding of the context and urges a longitudinal case study approach to further the workplace built environment knowledge.

In this study, I choose a single instrumental case study approach (Stake, 1995, p.3) to explain, explore and evaluate (Yin, 2015) the solution to the workplace problem identified in my practice. Despite Eisenhardt (1989) arguing that more cases will lead to better theory generation, Dyer and Wilkins (1991) quoting Dalton’s (1959) rigorous study at the Milo plant, urges studying a single case in detail for understanding. On the benefits of a single case study approach, they state; “a single case...leads researchers to see new theoretical relationships and question old ones.” The single case study of the accident induced behavior changes in Phineas P. Gage progressed the field of neuropsychology (Larner and Leach, 2002). This challenges the view that scientific knowledge cannot be obtained from a single case study, and the perspective that theoretical knowledge is better than case knowledge.

The case study approach was selected because it provides an in-depth appreciation of a complex issue, and enables exploration of professional attitudes and experiences in its natural real life context (Crowe et al., 2011). In line with the views of methods researchers earlier, Crowe et al., (2011) and Doolin (1998) suggests that an interpretative approach to case study research is relevant when trying to understand individual and social behaviors. For an in-depth understanding of phenomena, qualitative enquiry of situations within case study is important. This becomes relevant when cases with clear boundaries are present and when

attention has to be given to the situations within “particular places, times, social backgrounds, communication styles, and other backgrounds for the activities and relationships being studied.” (Stake, 2010, p.52)

A case can be defined “as a phenomenon of some sort occurring in a bounded context.” It can be graphically represented as a circle with a heart in the center, wherein the heart is the focus of the study and the circle represents the edge of the case that will not be studied (Miles, Huberman, Saldana, 2014, p.28). The unit of analysis in a case study is the case and not the subject of investigation (see Merriam and Tisdell, 2015, p.38). These qualities make case study a suitable research method in the current context to understand the impact of the workplace built environment on the employees. The two divisions (training and manufacturing) in which the solution will be implemented is the unit of analysis in this study.

This single case study will be the narrative of my endeavor to build a workplace environment designed for success in India. The result of this study will be the case narrative, making the reader sensitive to the context, findings and resulting impact of built environment on behavior and organizational success. This study will be unique, as these aspects within this particular setting and context cannot be obtained from available literature. The potential of this case study to further knowledge and inspire research in the fields of built environment through demonstrated impact makes it a valuable research contribution.

### **3.1.5 Research Quality**

In a qualitative research paradigm, “Reliability and Validity are conceptualized as trustworthiness, rigor and quality” (Golafshani, 2003). To pursue a trustworthy study, Guba (1981) suggested that qualitative researchers should address the four constructs of credibility, transferability, dependability and confirmability while conducting the research study. These naturalistic concepts correspondingly identify with internal validity, external validity, reliability and objectivity from a positivist investigator perspective. Many have accepted Guba’s four constructs as means to maintain research quality in qualitative studies (Shenton, 2004). As this study will adopt a case study research method with an ethnographic narrative and constructivist-interpretive epistemology, Guba’s four constructs have been incorporated into the study design to maintain research quality (Denzin and Lincoln, 2011, p.13) as stated below:

### **3.1.5.1 Credibility**

Credibility is an important factor in establishing trustworthiness (Lincoln and Guba, 1985). It deals with ascertaining congruence of the research findings with reality (Merriam, 1998) and confidence that the phenomena under study have been accurately depicted (Shenton, 2004). To ensure better credibility, I paid attention to participant selection, prolonged time spent in the field, used established research methods, collaborated with participants, took steps to ensure honesty in participant data, added reflective commentary to the captured data and triangulated themes emerging from the field data using multiple methods.

In addition, I undertook frequent peer review of the research project as Van Heugten (2004, p.208) states that subjectivity must be “open to intensive scrutiny” and “challenged on an ongoing basis”. Therefore, while framing the research project and during its progress, feedback was solicited from academics at Warwick Business School and peers in the DBA programme. This allowed my assumptions to be challenged, reduced scope for researcher bias and provided an opportunity to refine the research design and methods. To further build on the credibility criteria, I also assessed degree of congruence of the current study findings to past relevant studies in literature (Silverman, 2006) and this assessment is outlined under the section on study conclusion.

### **3.1.5.2 Transferability**

Transferability represents the degree to which study findings can be applied to other situations (Merriam, 1998) by providing sufficient contextual information (Lincoln and Guba, 1985 and Firestone, 1993) for a thick description of the study situation (Shenton, 2004). A rich description will allow the reader to relate the findings of this study to their own situations (Bassegy, 1981) and permit the readers to make a transfer to draw their inferences (Lewis, 2009). To facilitate transferability, study boundaries have been described in detail (Pitts, 1995) by explaining the research setting, number of participants in the study, participant selection methods, data collection methods employed, duration and frequency of data collection sessions, and study period of data collection (Shenton, 2004).

Despite difficulties in generalizing and applying study observations to different situations (Erlandson et al., 1993), Stake (2010, p.18) and Denscombe (1998) argue that each unique case is an example within a larger broader group. Although results obtained may be different due to different contexts, a detailed description of the enquiry methods will allow a reader

and user of this study to judge methodological coherence, and allow a future researcher to repeat data collection and analysis methods adopted in this study to different situations (Shenton, 2004).

### **3.1.5.3 Dependability**

This concept revolves around the ability to repeat study observations and field results through a detailed description of the enquiry method. Despite qualitative studies being, “static and frozen in the ‘ethnographic present’” (Florio-Ruane, 1991), dependability can be confirmed through demonstration of credibility (Lincoln and Guba, 1985). As such, dependability of the study is reliability of study data through researchers and time (Hays, Wood, Dahl and Kirk-Jenkins, 2016). Description of the research design, its implementation, operational details of data gathering approaches adopted and researcher’s reflective appraisal of enquiry methods effectiveness will enhance study dependability (Shenton, 2004). To further improve study dependability, an integrated model for developing a built environment designed for success is suggested, and then implemented through the developmental study.

### **3.1.5.4 Confirmability**

Confirmability is about ascertaining that study findings are the views of participants themselves without interference from the preferences and views of the researcher (Shenton, 2004; Guba, 1981). As this study is constructivist and interpretive in nature, participant experiences must be captured in an unbiased manner (House, 2005). To reduce researcher bias creeping into the study, on-going reflective commentary must be practiced during the fieldwork (Shenton, 2004; Creswell and Miller, 2000) through maintaining daily diaries, reflection and methodological logs (Drake, 2010; Lincoln and Guba, 1985). Miles and Huberman (1994) also highlights the importance of researcher admitting preferences, biases, values, reasons for favoring one approach over others and weaknesses in the methods adopted by practicing self-reflexivity (Van den Hoonaard, 2002, p.88).

Knowledge generated through research is also considered convincing if data collection and analysis is made transparent (Greenwood and Levin, 2007) through explaining inquiry methods, thematic coding process, and maintenance of an audit trail. Thus, by adopting these concepts on research quality into the study design, this research report strives to ensure credibility, facilitate transferability, establish dependability and affirm confirmability in the study (Greene, 2014).

### **3.1.6 Researcher positionality**

In qualitative research, as researcher is the primary instrument for data collection and analysis (Bourke, 2014), credibility of the researcher is paramount (Patton, 1990). A scrutinizer's trust in the researcher is as important as the adequacy of research methods adopted in the study (Akin et al., 1979). Positionality is the practice of describing the researcher's position in relation to the study (Qin, 2016) through clarifying personal experiences and worldviews that can shape the research inquiry and analysis process. As research occupies a shared space between researchers and participants (Dwyer and Buckle, 2009), both have the potential to impact a research process. Therefore, recognizing inherent self-biases will empower the researcher with insights on how one might engage with participants (Bourke, 2014). Researchers should thus be cognizant of one's positionality through reflexivity that "involves a self- scrutiny on the part of the researcher" (Bourke, 2014) and "a continuing mode of self-analysis" (Callaway, 1992, p.33) earlier in the research study. A review of researcher positionality in qualitative research should also include personal and professional background of the researcher such as gender, race, educational background, political stances, beliefs and socioeconomic status (Maykut and Morehouse, 2002).

As I am the primary instrument for data collection and analysis, stating my positionality becomes important for understanding the impact of my worldviews on the study (Foote and Bartell, 2011). I am a 35-year-old male, Indian national, resident in India and CEO promoter of the company where the study will take place. I am an engineer and biologist by training with management experience of 12 years at the company.

Since "Cogency of the research process rises from the relationship between the researcher and the participants" (Bourke, 2014), it is necessary that I become self-aware, explain my association with the organization members and existing culture of the research setting (Greene, 2014). I built the company together with a team of founding members and over the years, moulded the organization to espouse values of Integrity, Humility, Service excellence and Co-prosperity. This created a close family bond amongst the employees, with me and our respective families.

As I the researcher, is a member of the organization studied (Greene, 2014), research one's own social group (Naples, 2003, p.46), share common cultural and occupational characteristics with the participants (Loxley and Seery, 2008) and have intimate knowledge

of the community being researched (Merton, 1972), I am a “total insider” (Chavez, 2008), who shares profound experiences, values, beliefs, perspectives, cultural awareness and knowledge of the participants under study (Banks, 1998). With an insider researcher positioning at my everyday work location, I could blend into the situation without orienting myself or disturbing social routines in the research setting (Aguiler, 1981). I could leverage my preexisting knowledge on historical backgrounds of the research situation (Chavez, 2008), familiarity with study participants (Bell, 2005) and natural interactions (Aguiler, 1981) to ask meaningful questions, read non-verbal cues, project authentic understanding of the behavior observed and understand the psychological and emotional states of participants (Merriam et al., 2001, p.411). I also obtained “expediency of access” to information (Chavez, 2008) and acceptance amongst the participants for the research purpose (Dwyer & Buckle, 2009; Greene, 2014).

Despite the advantages, insider researchers immersed in the culture of the research settings can find it difficult to ask provocative questions (Merriam et al., 2001), become influenced (Lincoln and Guba, 1985), make assumptions based on past knowledge leading to loss of critical engagement and threaten objectivity (DeLyser, 2001; Roth et al., 2007; Drake, 2010), limit the analysis of social patterns (Aguiler, 1981) and confront ethical and methodological challenges often not faced by outsider researchers (Breen, 2007). There is thus a need to increase distance between the researcher and participant, and overcome familiarity during interactions relating to the research subject (Greene, 2014). Therefore to prevent deferring responses from participants such as “You know what I mean or we talked about that before”, I began research interactions with a disclaimer – “although we know each other and I am aware of the background, it would be best if you pretend that you are talking about it for the first time to a person who has no awareness of the background” (Chavez, 2008).

I was also mindful that information about colleagues could negatively affect relationships (Bell, 2005), have potential for interactions to become uncomfortable at times (Greene, 2014) and I took care to ensure that I “contemplate the potential repercussions that professionalizing the personal may have” (DeLyser, 2001, p.446, as cited in Chavez, 2008, p.483). Since positions in relation to the norms and cultural values of the researcher and participants can change through the research process (Merriam, et al., 2001), I ventured into the field study after taking these precautions in the study design. To critically engage with the field data, I continued asking questions during the research process similar to how I would ask thought provoking questions in my role as CEO in the organization. I also resorted to impression

management (Chavez, 2008) with “a skillful performance on the part of the researcher” (Greene, 2014) to persuade the participant to reveal true opinions. This was done through blinding the study design and research intentions to the study participants (see section 3.3.1.4).

Awareness of the researcher and participant bias can be a source of insight and alleviate the effects of these biases (Aquiler, 1981). After reflecting on the possible researcher biases, I concur that “The selection of a topic that clearly reflects a personal interest and the selection of colleagues as subjects raise the spectre of insider ‘bias’” (Van Heugten, 2004, p.207). Researcher bias creeping into the study refers to my potential as the researcher to project my values, beliefs and experiences onto the participants during interactions and data analysis (Greene, 2014). On the researcher bias molding interactions, I approach this research topic with an air of skepticism (Kilduff and Mehra, 1997), as suggestions from literature seemed too good to be true for my logical engineering mind. As I have no personal interest in either proving or disproving the effect of the solution intervention, it is unlikely that researcher bias can creep into the study.

As research context and participants determine researcher position in the study (Holmes, 2014), Chavez (2008) suggested that insider researchers should recognize ways in which they are like or unlike their participants and identify individuals who can facilitate or complicate the process by collecting reflective data, interviewing oneself, deconstructing the familiar world and engaging with others on their experiences (Van Heugten, 2004). After this analysis, I appreciated the possible limitations that my position as CEO could bring to the research front through my inaccessibility to some participant information by my exclusion from informal networks within the organization (Mishra, 1990). However, I did not see this as a concern as there was a prevailing flat hierarchy in the organization and the research problem was positioned as an effort to gather knowledge that will benefit everybody in the organization.

As positionality is relative to participants, I further elaborate on the research context by explaining my beliefs and values that influence my interactions at the workplace (Maykut and Morehouse, 2002). Personally, I am an optimist and believe in the potential of every individual. Honesty and impartiality is my policy, and this practice helped me to gain the trust of my colleagues. Over the years, my role evolved from an active operational ownership to more of a facilitator. This culture of empowerment and engaged employee relationship

helped me to understand the problems faced by employees, as they were forthcoming in voicing their thoughts and opinions. This background work ethos prevalent in the company facilitates a research process that requires reliance on participant thoughts and perceptions. My hands – off management style (Hassell, 2018) also ensured that there was no confusion created due to my dual role of an executive and researcher. However, I participated in the activities of the training division out of my passion for conducting physical experiments. This helped the research purpose as I could observe participants in the building without any noticeable changes in my routine.

Quality of data interpretations generated will also depend on participant reciprocity (Lincoln, 1995) that in turn depends on participant benefit, a sense of care and trust. Participant benefit was explained while mentioning the blinded research focus to participants. Trust with participants was facilitated by the existing dynamics and culture within the organization. Sense of care to participants was ensured through compliance to the research ethical code.

### **3.1.7 Source of Funding**

To explain any conflict of interests, Patton (1990) highlighted the need for revealing sources of funding for the study. Studies were funded by the organization, after my proposal to the Board of Directors on the need for future expansion to support growth and streamline operations.

### **3.1.8 Ethics**

Before proceeding with the fieldwork, approval for the study was granted by the Ethics committee at Warwick Business School (Appendix 1). Consent forms from study participants and permissions granted by the organization to do the study have been made obvious in this thesis (Appendix 2).

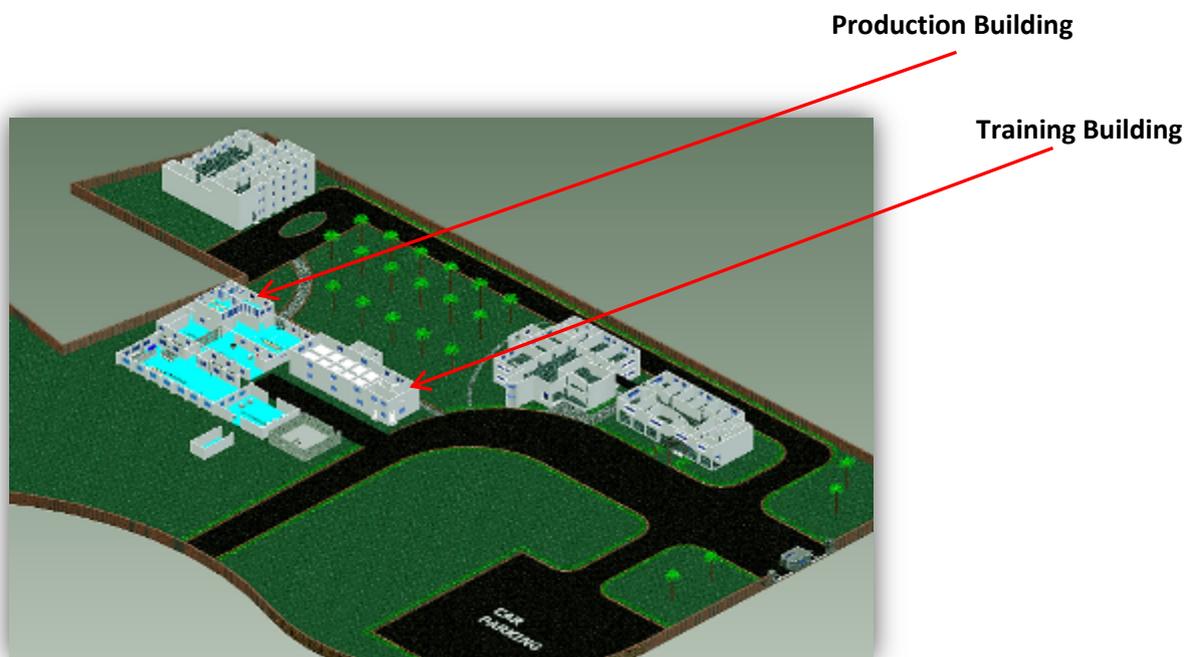
## 3.2 Pre-Field preparation and planning

### 3.2.1 Overview of the Organization

To facilitate understanding of the organization in the built environment research context (Moffatt and Kohler, 2008), this section outlines its built environments, operating divisions, personnel structure and my schedule of periodic interactions with the team.

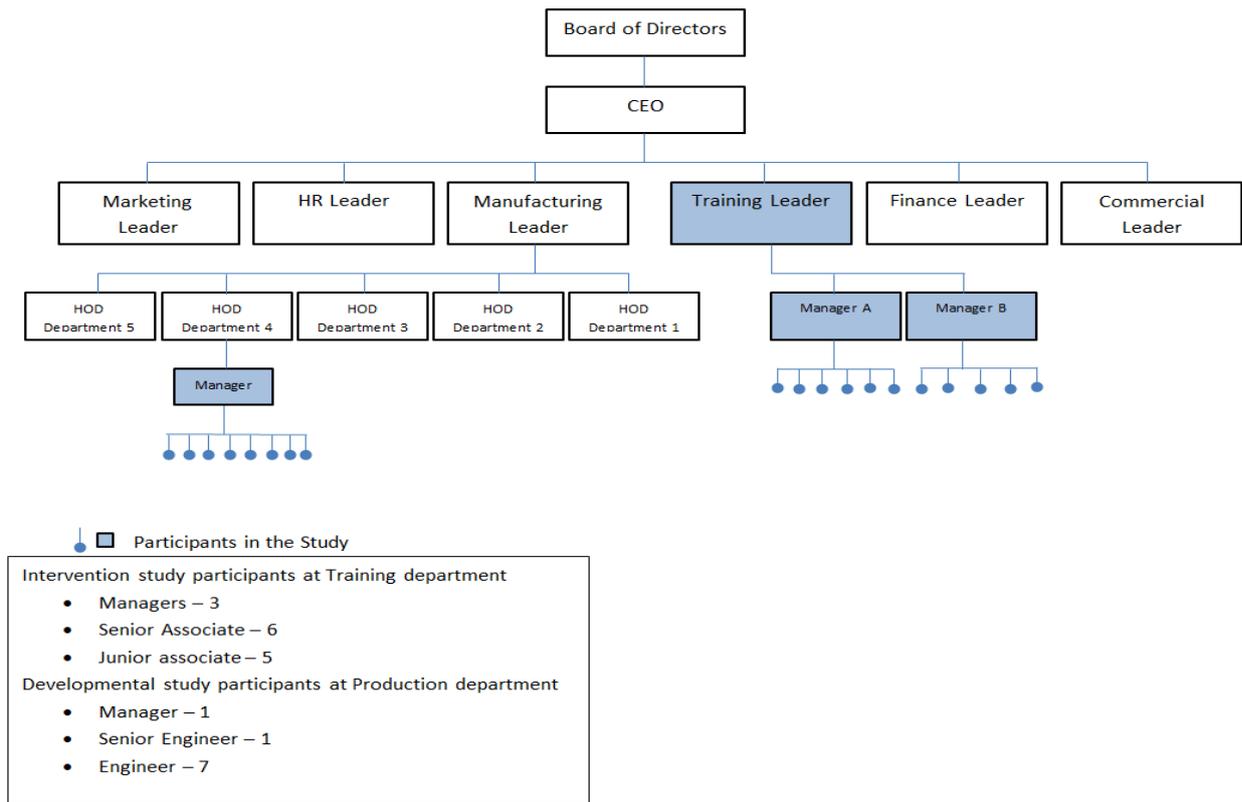
The organization has two revenue generating divisions – Manufacturing division and Training division. The manufacturing division consists of several departments that work together to manufacture the products. The different departments and respective activities are housed in six separate buildings within the four-hectare organization compound.

The training division operates out of a separate stand-alone training building in the organization compound (see Figure 3.2). The training building houses all division employees and activities under the same roof. The smaller training division and larger manufacturing division operate independently, and have no overlap of people, operational processes, infrastructure and customers.



**Figure 3.2: General layout of the existing Organization facility**

### 3.2.1.1 Abbreviated organogram of the organization (Figure 3.3)



### 3.2.1.2 Schedule of my interactions with the team prior to field research (Table 3.9)

Meetings	Participant members of the organization	Frequency
Board of Directors Meeting	Chairman, Board of Directors and CEO	Quarterly
Leadership Meeting	Manufacturing Division Leader, Training Division Leader, Finance Leader, HR Leader, Commercial Leader, Sales and Marketing Leader, Administration Leader	Monthly
HOD Meeting	5 Sub - department heads within the Manufacturing division, Training division Leader, Two managers within the training division, Manufacturing Division Leader, Commercial Manager, HR Manager and Administration Manager	Weekly, Every Monday 8AM to 9AM
Manufacturing Division Meeting	Manufacturing Division Leader, 5 Sub- Department Heads, Managers and Assistant Managers of the Manufacturing Division	Once a week
Training Division Meeting	Training Division Leader along with 8 Permanent employees of training division and 5 employees on rotation within the division	Once a week
Employee Outreach Meeting	Every employee in the organization, by turn will meet me once a month in the evening for a thirty-minute casual interaction.	

### 3.2.2 Presentation of the Study approach

Field analysis and steps in the research process have been narrated in a chronological order for easier understanding and to visualize the research process through a thick description that will “ring true” to the reader, and to add to the confirmability construct in the study (Shenton, 2004). Chronological order refers to the sequencing of events as they occurred and is suitable in a case study research scenario (Mills, Durepos and Wiebe, 2010). To facilitate temporal awareness, major events in the research process have been codified into identifiers marked in red (see Table 3.11), referenced in the corresponding relevant sections and charted into a timeline box (see Table 3.10) based on their time of occurrence as shown below:

**Table 3.10: Study Timeline**

2016		2017			2018				2019				2020		
Oct to Dec	Jan to Mar	Apr to Jun	Jul to Sep	Oct to Dec	Jan to Mar	Apr to Jun	Jul to Sep	Oct to Dec	Jan to Mar	Apr to Jun	Jul to Sep	Oct to Dec	Jan to Mar	Apr to Jun	Jul to Sep
A1, A2, A3, A4	A5, A6, B4	A7, B5	I0	C	A8, A9, A10, I1	I1, I2, I3	I4	I4	I4	I4	I4		Thesis completion		
B1, B2, B3			D0	D0, D2	D1	D1	D1	D1							
					D2	D2	D2	D2, D3	D3	D3	D3	D3			

**Table 3.11: Event identifiers**

Identifier	Description	Period
<b>A1</b>	Identification of the need for a new facility	October 2016
<b>A2</b>	Approval of the plan to build a new facility after due diligence	November 2016
<b>A3</b>	Debriefing with the Head of departments on decision to build a new facility	November 2016
<b>A4</b>	Delegate coordination responsibilities to a devoted team	November 2016
<b>A5</b>	Solicit views from HODs	December 2016
<b>A6</b>	Solicit views from HODs to make a better facility	December 2016
<b>A7</b>	Survey of existing built environment by vedic architecture (Vaastu) consultant	10 <sup>th</sup> June 2017
<b>A8</b>	Introduction of the research study to the HODs	January 1 <sup>st</sup> 2018
<b>A9</b>	Introduction of the research to prospective participants	January 3 <sup>rd</sup> 2018

<b>A10</b>	<b>Participant Debriefing</b>	<b>January 17<sup>th</sup> 2018</b>
<b>I0</b>	<b>Selection of the intervention study building</b>	<b>September 16<sup>th</sup> 2017</b>
<b>I1</b>	<b>Pre-intervention data collection</b>	<b>Jan 19<sup>th</sup> to May 21<sup>st</sup> 2018</b>
<b>I2</b>	<b>Participant briefing to schedule the training building renovation</b>	<b>May 22<sup>nd</sup> 2018</b>
<b>I3</b>	<b>Training building renovation</b>	<b>May 23<sup>rd</sup> to June 10<sup>th</sup> 2018</b>
<b>I4</b>	<b>Post Intervention data collection</b>	<b>June 11<sup>th</sup> 2018 to May 2019</b>
<b>D0</b>	<b>Developmental Study Starts</b>	<b>July 5<sup>th</sup> 2017 to Nov 2017</b>
<b>D1</b>	<b>Pre – Occupancy Data Collection in the existing production building</b>	<b>Jan 19<sup>th</sup> 2018 to November 7<sup>th</sup> 2018</b>
<b>D2</b>	<b>Designing and constructing the new green field building</b>	<b>November 2017 to October 2018</b>
<b>D3</b>	<b>Post Occupancy data collection in the new building</b>	<b>November 12<sup>th</sup> 2018 to November 2019</b>

### 3.2.3 The Study Process

#### 3.2.3.1 Background to the study - Business Need for constructing the new facility

- 1) During a strategic review meeting with the leadership team, need for constructing a new facility was identified to support growth and streamline operations. **A1**
- 2) With supporting evidence from stakeholders, due diligence and verifications, I approved the plan to build a new facility to be ready by 1 November 2018. **A2**
- 3) Once the need for an additional facility was formalized, Head of the departments were briefed on the same. Their views, feedbacks and thoughts were solicited and they were also urged to think of ways in which the workplace built environment could be made more effective. **A3**
- 4) Thereafter to build a new facility, I delegated the coordination responsibilities to a devoted team and followed up on a weekly basis to monitor progress. **A4**

In the background, I had become increasingly conscious of adopting new innovative approaches to create sustainable growth (Bakker, 2009). Therefore, my exploration in practice followed a cyclical process of together reviewing literature, engaging with external consultants and eliciting thoughts from relevant organization members (Table 3.12 below).

**Table 3.12 Sequence of Events with timeline identifiers**

Within the Organization	Outside Organization	Insights through Literature Review
To build a new facility, I organize a team and delegate coordination responsibilities. <b>A4</b>	Architects are engaged to make the blueprint of the facility design. <b>B1</b>	On exploring possibilities for building a built environment for success, role of built environments on influencing human behavior and performance.
During another routine weekly HOD meeting, I solicit views enquiring about aspects that they think will make the new facility more satisfying, productive and happy for the people. Discussions divert to exploring process flow optimizations. <b>A5</b>	Upon personally enquiring with leading architects on the relation between built environment and organizational success, they turn their attention to understanding operational processes and optimizing costs. <b>B2</b>	This experience was in line with findings as noted in literature (Vaughan, 2013; Venturi, Scott Brown, Rattenbury, & Hardingham, 2007).
During a subsequent weekly HOD meeting, I reflect on earlier comments from employees that certain rooms are better than others for meetings. I draw upon the overwhelming sentiment amongst the team members that certain rooms encourage successful outcomes versus others. They did not seem to have any reasoning to support that sentiment. <b>A6</b>		While trying to understand the reasons for certain pockets of space to be perceived as more positive than others, I noted similar observations in literature (McCoy, 2005; Csikszentmihalyi, 1996; Becker & Steele, 1995).
	One architect highlighted that that perhaps vernacular architecture and Vaastu could have insights on creating built environments for success. <b>B3</b>	Numerous instances of psychological impact of built environments in literature. I also noted coverage on adoption of vaastu in the press.
	Realizations from the field and literature drove me to explore the subject and I discussed the same with my supervisor. Upon a go-ahead, I pursue an integrated solution to make a built environment for success in the organization and for the DBA. <b>B4</b>	I note few studies on the subject and sense opportunity to create competitive advantage for organization by integrating vernacular architecture practices with modern practices and contribute to literature in the process.
Post survey of the existing built environment, the consultant states several anomalies based on the principles of vedic architecture. Incidentally, the rooms that were perceived as not so positive by the occupants were highlighted within the anomalies. <b>A7</b>	I meet a vaastu consultant to understand his perspectives. To his statement that the organization will see benefits on adopting the tenets of vernacular architecture, I invite him to the organization. <b>B5</b>	I confirm his opinions with other vernacular architecture experts, books on the subject, journals and other literature sources.
Amongst the many ‘defects’ highlighted by the consultant; I decide to test the benefits of adopting vernacular architecture after an internal analysis. <b>I0</b>		Testing is easier in the Training building as controls can be maintained during the study and intervention implemented.
Formulate the research design for the study, separate my role as researcher and practitioner, review literature, finalize the research methodology and methods appropriate to the study. <b>C</b>		

### **3.2.3.2 Meeting with potential Architecture Consultants B1**

All three architectural firms that I interacted with highlighted their customer references, pricing efficiency, contractor liaison capabilities and competencies to coordinate a turnkey project. Upon enquiring on ways to design a facility for success, I received statements like, “Sir, a building is a building. How is company success related?”, “Achievement in business will depend on your people”, “In my experience, better operations methods will shower success”. One thoughtful vendor educated in the US opined, “There are natural buildings in the US to increase productivity. But I think they are all marketing fads, created to sell”. Another thoughtful individual voiced, “you can use solar panels, and make facility less maintenance, but success and everything will depend on your operation people. You agree right?”

However, one consultant suggested, “may be vastu can help” and claimed, “I have done several vastu compliant designs and many customers have experienced stability”. Upon questioning, “Does this work really?” he stated, “I know of several families enjoying happiness after vastu changes in their house but I don’t know if it is coincidence”. He added, “Even Ambani’s facilities are made according to it. Maybe there is something in it.” Mukesh Ambani is one of India’s most successful businessmen and was in the news a few years ago for modifying his house Antilla according to the principles of Vaastu (Bajaj, 2011; Birtchnell, 2016). During the facility visit, he highlighted several existing design features that were at odds with the principles of Vaastu or vedic architecture. I noted them for future reference, and learnt that he had a Masters in Architecture and knew “some basic” vastu principles through his family’s background in vernacular architecture. This consultant’s suggestion opened a new line of enquiry on vernacular architecture that indicated its emerging popularity amongst the local population (Sandilya, 2015; Chauhan, 2015). These realizations inspired me to connect with vastu consultants and subject matter experts to gain more insights.

The week concluded with selection of an architect based on modern architectural design flexibilities, physical proximity, credit ratings and other business factors. The architecture firm then started coordinating with new facility organization team.

### **3.2.3.3 Meeting with vastu consultants B5**

To gain knowledge on Vaastu, I consulted two prominent domain experts. Upon enquiring about the benefits of vastu, one of them stated, “without doubt, correct vastu will bring in

positive energy and happiness to your company”. I therefore wanted to review vastu compliance of the existing built environment before incorporating these principles into the new facility. Both consultants suggested a survey of the existing built environments that was done on non-working Saturdays to prevent any occupant impression formation. Thereafter both consultants highlighted similar areas of non-compliance. However, I engaged the services of the consultant who was open about explaining the fundamentals of vastu, retired and passionate about propagating its principles.

Upon his subsequent visits to the organization on non-working Saturdays, he seemed to focus more on entrance position of buildings and space layout. While walking around the premises, he indicated several physical locations in the built environment that had to be remedied for vastu compliance, “You have to correct this defect to achieve full potential”. I recorded them in a diary for analysis and follow up.

### **3.2.4 Selecting (shortlisting) the intervention study Building 10**

When problem areas mentioned by the vastu consultant were analyzed, I realized that most suggestions were not easy to be incorporated amidst ongoing business operations. Although I had the option of incorporating these principles directly into the new green field facility, I utilized the DBA to initially test the solution against occupant psychological benefits indicated in literature.

To test the proposed vernacular solution within the organization, I had to apply the intervention to a building that housed and served as the sole area of operation for one complete division in the organization. To associate the intervention with tangible outcomes, this division also had to be independent with standalone revenue recognition scheme and not be affected by operations and individuals within other areas in the organization. Therefore, I developed a preference for selecting the training division building as the intervention site. I then engaged with the consultant to identify factors to make the building vastu compliant.

Upon review of the training building by the consultant on a non-working Saturday, his comment while entering the building stunned me. He enquired, “What business runs in this building”. When I said training, he murmured, “I am sure it will not be doing well. May be no successful work on time and sad, lifeless people?” His comment much to my amazement was indeed the case, with the division consistently underperforming despite positive market

potential. On enquiring the reasons for his judgment, he stated, “When the heart and nose of the building is not positioned right, will people not be choked”. I connected his comment with ‘humanizing’ the building as mentioned in literature. Upon enquiring further, he elaborated, “like human body, much like mother earth is a system with set rules. Life, objects and everything around will have their right positions and proportions to be in harmony”. He further added, “Energy is universal and flows in patterns. Design of buildings should follow its natural flow.” I then shared my intention to confirm the benefits of the intervention through the DBA and requested his cooperation, at which he stated, “I have no experience of research” but expressed his opinion that “if vastu studies are done well, benefits will be seen”. He further suggested some books that could be helpful for my purpose and expressed hope for revival of vernacular architecture when he mentioned India’s premier university, “now even IIT Kharagpur has started separate vedic architecture department” (Pandey, 2017).

While explaining the rectification required to correct the ‘defect’ in the training building, he stated, “You have to change the position of the entrance”. Upon voicing concern that the suggestion might require extensive modification to the building, he stated, “This not compromisable. There is no escaping from this basic requirement”. The solution suggested was also in line with descriptions in vernacular literature (See section 2.0) and I decided to proceed with the modification with the reasoning that expenditure will be worth the trial, if any positivity accrues to the training division. The consultant then sketched the design “corrections” and I drew a dimensional blueprint for the building using Autocad (See 3.3.2).

## **3.2.5 Determining Execution Time**

### **3.2.5.1 Building renovation in the Intervention study**

The proposed blueprint for the training building was shared with the existing contractor, responsible for civil works in the organization. After reviewing the facility and blueprint of modifications, he opined that the work could be completed in two weeks’ time as there was no modification to the core building structure. I then explored the training work calendar to look for possible periods when building renovation could be scheduled that will be convenient to both business and research.

### **3.2.5.2 Green field facility in the Developmental study**

By the time, resource and operational requirements were close to finalization in the new facility; I had developed a close rapport with the vastu consultant. Well aware of my research intention, the consultant agreed to be introduced to the developmental team as an expert with several years of real world experience in constructing new facilities. This scheme ensured that vastu compliance of the new facility was addressed during the design phase itself without disclosure of the consultant's vastu identity that might predispose the study to biases within the development team and future occupants. Prompt simultaneous incorporation of vastu principles ensured that the facility completion timeline remained at the initial estimate of November 2018.

### **3.2.6 Determining duration for data collection in the study**

Data collection in a qualitative research should be carried out until saturation, when data collected and analyzed is sufficient enough to ensure that further data collection and or analysis is unnecessary; and is operationalized through determining duration of field research in prior studies (Saunders et al., 2018).

I therefore used field duration of past studies as an indicator to arrive at appropriate draft timelines. However, “one could count the number of articles written or problem solved” in pre and post occupancy built environment studies due to the difficulty in coordinating and executing such research (Heerwagen, 2000). Authors have however emphasized the need for sufficient duration of data collection in the field to minimize – ‘halo effect’, wherein occupants in a new facility experience positive feelings merely by being in the revamped facility (Heerwagen and Wise, 1998); ‘Hawthorne effect’, when occupants respond positively to the involvement of the researcher and any changes in the built environment (Hedge et al., 1995); placebo effects on occupants (Menzies et.al; 1997); changes in user preferences, feelings and behaviours due to different seasons in the year (Schreuder et.al., 2015; Menzies et.al., 1997; Heerwagen, 1990) and effects of occupant feelings during periodic staff appraisals (Heerwagen and Wise, 1998).

To prevent these biases and to familiarize occupants in built environments, Schreuder et.al., (2015) conducted pre-occupancy survey 3 to 7 months before occupying the new building and post-occupancy survey 5 to 8 months after moving into the new building. Similarly,

Heerwagen and Wise (1998) conducted survey study in the old building 1-month prior to the move and post-occupancy study 9 months after moving into the new building. Alternatively, Montgomery et al. (1994) tracked absenteeism and productivity 1 year prior to renovation and 1 year after renovation, and Heerwagen (1998) collected field data one year before and one year after the moving into the new building. Menzies et.al., (1997) undertook a 16-month post intervention study and Hedge et al. (1995) did the post renovation questionnaire over 12 months after completing the renovation work.

Thus, researchers collected pre-intervention data about 3 to 4 months before the intervention and spent about a year before collecting post occupation data in the new built environment. Although these studies were largely questionnaire based, I used them to indicate approximate timelines to overcome inherent research biases that disappear with sufficient time spent in the field through prolonged engagement (Lewis, 2009; Erlandson et al., 1993; Lincoln and Guba, 1985) and field familiarity (Shenton, 2004).

Therefore, based on the estimated timelines for training building renovation, new facility construction, data collection, DBA study period and organization business needs, I outlined the research design to start the intervention and developmental study data collection at the same time. I collected data until saturation through an ongoing process of analysis and reflection (Lebaree, 2013), and spent more than 22 months in the field. Pre-intervention data collection lasted for about 5 months and post-intervention data collection for about 11 months in the training building. Similarly, pre-occupation data collection in the old production building lasted longer at about 10 months until the new facility reached occupation stage and post occupancy data collection lasted for about a year.

### 3.2.7 Controls in the Study

#### 3.2.7.1 Understanding Confounding variables in the research setting

Since research findings will depend on methods adopted in the study (Michie and West, 2004), I focused on understanding confounding variables in the research setting that can influence study outcomes. As occupant moods can be affected by several variables and as this study focuses on understanding the psychological impact of the built environment on workplace occupants, it was essential to understand the influence of other moderating factors (Srinivasan et al., 2003). Confirming research quality will depend on identifying and controlling all the other mediating variables that have been shown to affect workplace behavior. Consequently, to develop a comprehensive study and intervention, I used ecological models to provide a framework for integrating theories and variables at each level of the organization that are expected to influence behavior (Sallis et al., 2015, p.45).

To gain an insight of the multiple variables in the workplace that affect psychological moods, I applied a funnel approach (Martin, 2010); first mapping the organization variables influencing human behavior at the work place and then filtering down to the variables specific to the workplace built environment that influences human behavior and hence the study outcome.

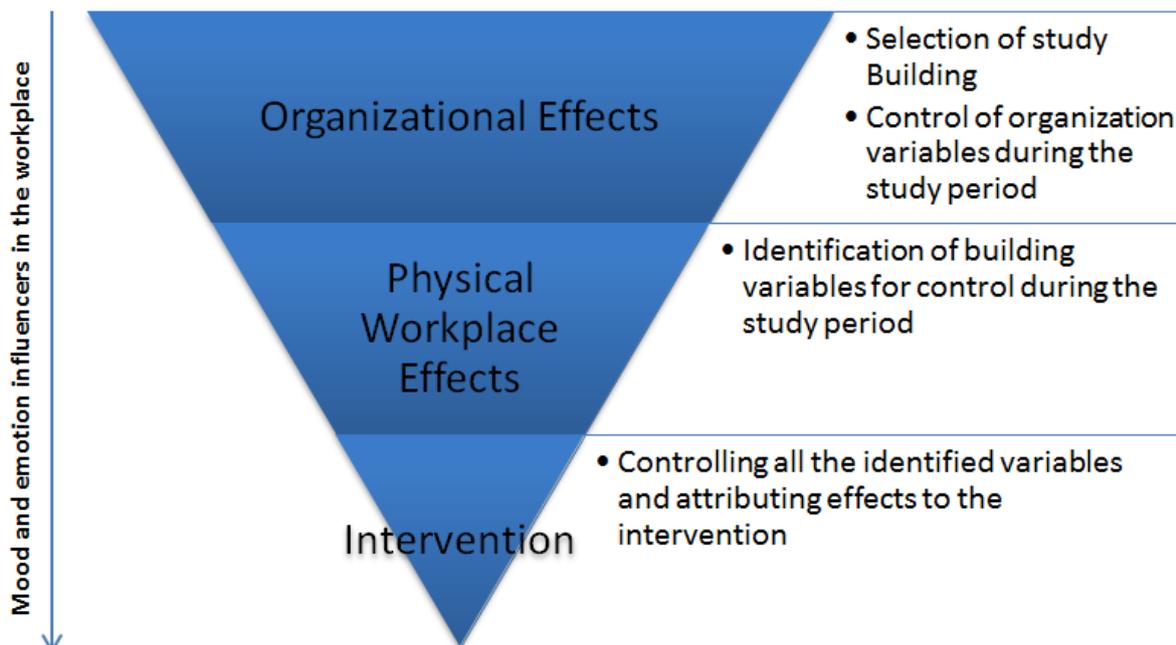
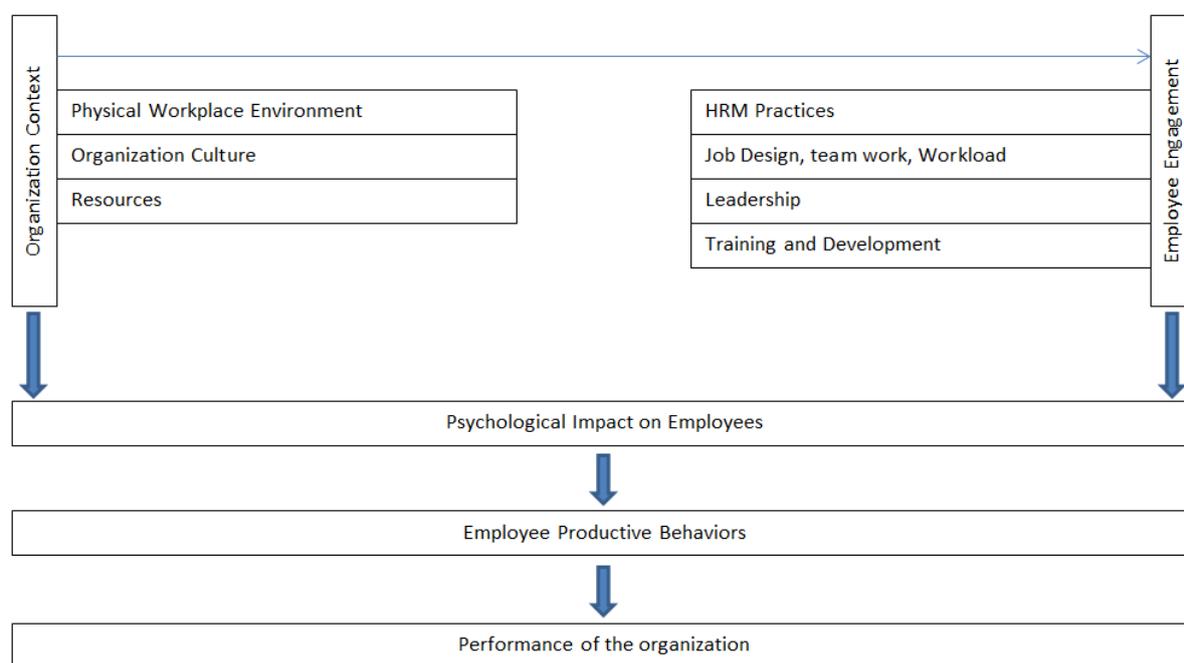


Figure: 3.4: Confounding variables

Source: Compiled for the study

### 3.2.7.1.1 Organizational Influences

An organization's performance depends on organization influences that affect employee wellbeing, health and performance (Michie and West, 2004). As psychological effect on employees at the workplace and resulting employee behavior is a function of linkages and cross linkages amongst organizational influencers, I mapped the potential organizational factors:



**Figure 3.5: Organizational Influences**

Source: Adapted from Michie and West, 2004

As indicated, organization influences on affect and behavior can be categorized into employee engagement practices and contextual factors. Employee engagement includes human resource policies, workloads and job design, leadership and personnel development sessions. Contextual factors include culture, resources and physical workplace environment. As this study aims to determine benefits of adopting vernacular architecture, organizational influencers outside the scope of intervention have to be maintained constant.

### 3.2.7.1.2 Analysis of organizational influencers to Finalize the study Building

Feasibility of controlling organization influences between the two organization divisions were determined as indicated below:

<b>Organization Influences</b>	<b>Manufacturing Division</b>	<b>Training Division</b>
Physical Workplace Built Environment	Inter-related Activities and staff spread across six separate buildings in the facility compound.	All activities and staff housed in a single building.
Organization Culture	The entire organization has the same Ethos and values.	
Resources	Variable. Fixed asset requirements can vary depending on the workload.	Resources needed are constant.
Human resource practices	Human resource and staff requirements can vary. Policies remain constant throughout the organization.	Constant resource requirements.
Job Design and workload	Workloads can vary. Hence work timings beyond normal office hours differ from day to day.	Workload remains constant. Work timings are regular office hours.
Leadership	HOD driven – Task allocation has a Top down approach and regular monitoring	HOD decides through team consensus.
Training and Development	Periodic training across the organization driven by internal senior management.	
On analyzing retrospectively, background division problems highlighted in view of vaastu consultant's assessment	Interrelated, cross-functional nature of activities across teams make causal association tough.	Single building and single team activity make causal relationship plausible.

**Table 3.13: Analysis of Organizational Influencers**

Based on this analysis, I reaffirmed my earlier understanding to choose the training building as the site of intervention study. After controlling for the organizational influences, I focused on controlling built environment confounding variables that could impact the study outcome.

### 3.2.7.2 Importance of controlling workplace built environment variables

Although several studies have attributed building conditions to occupant perceptions, work performance and attitudes, they have been sometimes inconclusive and contradictory due to the complexity of built environment system (Williams, 2013), nature of different study settings, difficulties to generalize conclusions onto a common ground, proper control of variables, time spent in the field and due to other possibilities that exist to influence study outcomes (Ahmed et al., 2016; Heerwagen, 2000; Heerwagen and Wise, 1998). Heerwagen (2000) reasoned the contradictory outcomes of fluorescent lamp studies between Collin (1993) and Veitch and Mccoll (1994) to the overall study design that did not control for the effect of windows, colour, furniture, positioning of worktables, personal control of lights and natural light conditions at the study site.

Individual variability towards environmental sensitivities has been another complicating factor in built environment study outcomes (Attaianese, 2017). Interaction of psycho-social environments with symptom inducing building factors make causality complex (Naess, 2016) as indications of lower productivity such as lack of concentration, irritability, and relationship amongst colleagues can be caused by several coexisting factors including individual mental states with “perceived psycho- social work environment the dominant risk factor” even for physically unrelated skin symptoms and mucosal irritation (Heerwagen, 2000).

Similarly, growing evidence of ‘Spirit lifting’ features in a built environment (Clements – Croome, 2006, 2017) that bestow positive experiences and promote emotional functioning not related to architectural design goals (Heerwagen and Wise, 1998) such as spatial design, naturalistic features of day light, contact with nature (Kellert, 2012, p.5), window views (Heerwagen *et al.*, 1999), and prevalence of ‘good places’ that promote emotional wellbeing (Frumkin, 2003) is another complicating factor in determining built environment study outcomes.

The challenge in built environment research is highlighted by Heerwagen (2000) when she states, “does the absence of symptoms by itself mean that one is in a state of well-being? Or is the sense of wellbeing associated with the presence of particular features and attributes, rather than just the absence of harmful ones?” Therefore, to attribute outcomes to the intervention and to improve research quality, I attempt to identify and control all the confounding variables in a workplace built environment that can potentially influence human behavior.

### **3.2.7.3 Variables in the Built environment - Physical Workplace effects**

Given the complexity of the built environment (Srinivasan et al., 2003) and after reviewing literature, I compiled physical built environment variables that have shown significance in shaping human behavior and social interactions under ambient factors in the built environment (see 2.2.1.1). The variables identified by several authors, were then compiled into a checklist and applied to ensure constancy of non-studied variables in the intervention study (see 3.3.2.5) and developmental study (see 3.3.3.4). Subsequently after taking due care in controlling con-founding variables, I then entered the field to identify possible study participants.

## **3.3 Enquiry Methods**

### **3.3.1 Entry into the Field**

This section describes how the researcher enters, orientates in the field and subsequently influences the fieldwork that follows (Chughtai and Meyers, 2017).

#### **3.3.1.1 Study Sites**

As this study will be done in two parts - as an intervention study and subsequently a separate developmental study, it can be construed as an instrumental case study wherein the research interest is studied across two separate sites (Stake, 2010). As such this case study focuses on addressing the research question and less on the complexity of the case unlike an intrinsic case study. Although executing the study across two separate sites can render greater credibility (Shenton, 2004), this study will not permit generalizations from a statistical perspective but rather attempts to identify themes and patterns that can be compared with other cases (Mills et al., 2010).

#### **3.3.1.2 Introduction of the research study to HOD's A8**

To align with organizational protocols, I positioned my research interest amongst the Head of Departments after blinding the study intention. During a Monday HOD meeting, my vision for promoting wellbeing at the workplace was articulated, and I expressed my keenness to

pursue a doctorate to spearhead employee happiness, creativity and competitive advantage. I emphasized that this study will require interactions with participants to understand elements of wellbeing captured through cyclical feelings and emotions without impeding day-to-day work during routine interactions. I outlined that to frame my initial understanding and to narrow down the study population; “I wish to give an opportunity to members of the training division and production members to be shifted to the new facility to become participants in the study”. I also mentioned that training division as a whole was considered for the study due to its smaller size and completeness for study purposes, and to leverage its experience of dealing with R&D projects. The HODs were excited and offered their willingness to be of help for the research study.

This was followed by a meeting with the production HOD and production members shortlisted for relocation to the new future facility. They were briefed in my presence to ensure that members were agreeing to relocate their workplace to the new facility out of voluntary choice as unhappy individuals could affect business sentiments and research process with preset psychosocial aspects (Wright, 2009), when controlling all factors other than the built environment variable is a study requirement.

### **3.3.1.3 Prospective Participant Selection**

All training division individuals were made prospective participants in the Intervention study. Similarly, all production individuals who would be shifted to the new facility became prospective participants in the Developmental study.

Including the entire affected population is in line with suggestions from built environment authors (like Menzies et.al, 1997) and will negate charges of researcher bias in participant selection (Shenton, 2004). It will also contribute to “multiple voices, exhibiting characteristics of similarity, dissimilarity, redundancy and variety”, to gain greater knowledge of behavior than from individual participants who are contributing data (Shenton, 2004). This method also gives confidence that information gathered is representative of “selected society” being studied (Hamel, Dufour and Fortin, 1993) and has an advantage that opportunity is provided to reflect on the views of one and all of the affected population.

### **3.3.1.4 Pre-work before Participant Briefing to blind the study**

After observations by built environment authors on their inability to blind the study intervention to participants (like Smith et al., 2017; Menzies et.al, 1997), I reviewed literature to find ways in which I could blind the intervention and research intention to participants. A blinded research is one in which the information about the research process and objectives are hidden from the participant to eliminate or reduce biases such as observer bias, placebo effects and conscious deception (Robertson et.al, 2016). Karanicolas et al. (2010) quotes studies demonstrating superior validity after adopting blinding techniques in the research design. Advocating a blind study design in built environment research, Heerwagen and Wise (1998) suggested that understanding occupant benefits through a blind study could be the first step towards designing facilities that are supportive of human wellbeing and performance. As such, I took efforts to blind the study from participants by following cues from works of built environment authors.

Wyon (1996) recommended blinding the intervention approach in building productivity research by formulating a “chain of falsifiable hypotheses” to understand the effect of environmental conditions on human performance changes. To ensure that participants were unaware of any intervention in the workplace, Wargocki et al. (1999) hid the pollution source behind a screen while studying the effect of air pollution on human performance (Heerwagen, 2000). Similarly, while studying the human effects of ventilation in buildings, Nunes et al. (1993) made the participants unaware of the study intervention and manipulated dampers for airflow control without participant knowledge. They voiced that reporting bias in the study would have been reduced by keeping the participants unaware of the intervention and summarized the strategy adopted in the study by stating, “Each week, the participants, unaware of the experimental intervention, reported symptoms and the indoor environment was thoroughly evaluated” (Nunes et al., 1993).

Therefore, before every interaction with study participants, blinding strategies and review of research activities to date were consistently considered to take participant focus away.

### **3.3.1.5 Invitation to prospective participants to be part of the study **A9****

During this debriefing session, I started the meeting by stating, “Loads of interesting activities. We have a great future and I believe everyone here has a pivotal role to play”. I gave prospective participants an insight into the market conditions and touched upon our

organization vision, “to be the very best and create positive impact”. I also outlined our joint aspiration for growth and need for facility expansion to capture the market opportunity. This was done to reduce indifference and apathy among participants due to possible feelings of not being included during problem definition (Cassell and Johnson, 2006).

Introduction to the study was made by emphasizing a common purpose that, “the study outcome and knowledge gained could benefit us all and perhaps even our larger community”. I explained that research findings could enhance wellbeing, satisfaction and that “I wished to incorporate the findings into our organization to make it the best workplace to work for.” By positioning the study as an understanding of well-being in the organization, future participants would have been incentivized to be honest in their views and forthcoming during research interactions.

During interactions, I was mindful of my position as CEO in the organization and took steps to reduce the power differential with participants. As “during fieldwork the researcher’s power is negotiated, not given” (Merriam et al., 2001), I presented myself as a peer trying to find a solution that will be beneficial for all of us. In this way I tried to minimize the power differential (Breen, 2007; DeLyser, 2001) between the research participants and myself.

Subsequent to the research introduction, scope for minimal interruption to the daily routines was highlighted and was perhaps one reason for the enthusiasm with which the study prospect was received. After giving an insight into research procedures and clarifying concerns, I emphasized that participation was voluntary and took care to ensure that staff do not feel coerced to become research participants. By leveraging my existing friendly demeanor in interactions, I highlighted that “participation will be absolutely voluntary and there will be no hard feelings whatsoever to people who decide to not take part in the studies”. I highlighted a personal instance where, I did not become a participant for a dear friend’s research due to inability to devote time, “but we are still the best of friends and we support each other”. I emphasized through this example that participation is voluntary and also made clear that participants could leave the study in between and without mentioning any reasons, steps that will contribute to participant honesty (Shenton, 2004).

I then invited the individuals to be participants in the study and then explained that as part of the formal research process, participants would have to sign their consent. Interested individuals were then told to submit back signed consent forms within a fortnight.

### **3.3.1.6 Consent Forms and participation**

All individuals in the prospective participant pool agreed to be part of the study and signed the consent forms (see Appendix 2). With participation of all the prospective participants, there was reduced possibility of withdrawal bias and nonparticipation bias, wherein just one side of the participant views are heard (Bowling, 2014, p.180; Menzies et al., 1993).

The participant list was then finalized, and I classified the participants from training division into intervention study and participants from production division into developmental study. Participants were not made aware of the two studies running in parallel, structure of the research, and impact of built environment on behavior or anything thereof.

### **3.3.1.7 Participants in the study**

During 16 months of intervention study, all 14 employees in the training division were participants. Similarly, during 22 months of developmental study, all 9 employees in the manufacturing division to be relocated to the new facility were study participants. While the sample of participants was not large enough for a statistical analysis, inclusion of the entire affected population yielded significance in the research context. It also included variation in participant characteristics across dimensions such as Men and Women; Age range; those whose homes were closer to work and far away; and secular and religious individuals.

### **3.3.1.8 Participant debriefing on research protocol A10**

During this debriefing session, publicized research objective of understanding wellbeing was reintroduced. Thereafter, I explained that wellbeing was to be captured by determining the moods of participants at different times during the day. I then requested the research participants to: 1) rate their sense of wellbeing every working day at 9AM and 5:30 PM on a four point scale: 1 = very good, 2 = good, 3= bad, and 4 = very bad and to relate their feelings to specific workplace events if any, and 2) have an individual casual chat with the researcher every week for about half an hour to understand the recorded mood states. Participants were also explained that positive and negative feelings were complex and subjective. I clarified that “there will be times when causation for a particular feeling cannot be established or is personal. That is perfectly fine and quite human”. I then presented the participant daily log (Appendix 3) to capture data and suggested that it be completed along with daily time sheets. Schedule of face to face participant meetings (Appendix 4) was also presented.

### **3.3.2 Intervention Study**

This study focuses on reorienting entrance position within the built environment that has the supposed ability to alter affect and work productivity in people according to the principles of vedic architecture. The study approach complements past studies that have sought to map affect-eliciting attributes in built environments and reported effects of built environment factors on behavior, affect and performance (Knez and Kers, 2000).

#### **3.3.2.1 Intervention Study setting**

The training building provided in many ways an ideal setting for the study because of its small population (14 members) and independent operational status within the larger organization (see 3.2.7.1.2). With 16 months in the field, data collection period was in line with suggested duration for built environment research (See 3.2.6)

#### **3.3.2.2 Pre – intervention Data collection I1**

Pre – Intervention study was done for about 5 months with observations and journaling on the lines of data collection approach in the study (see 3.3.4). Before field data collection started, I made sure that organization influencers and built environment factors within the training building were kept constant during the study period (see 3.2.7). This data collected is presented in the section under study findings (see 4.0). Thereafter before proceeding to the intervention in the building, there was an intervention participant briefing.

#### **3.3.2.3 Intervention briefing and scheduling building renovation I2**

The training building intervention was discussed during the weekly training division meeting. As the vernacular architecture intervention will be a visible change to the workplace built environment and to reduce resulting biases, I advertised and positioned the intervention as part of a scheduled building renovation (Hedge et al., 1995). When several members enquired, “Is it required at this stage?”, “Should we spend on something else?”, I referred to a comment made during an earlier meeting when a member informed the team about minor cracks seen on the front walls of the building. I used that incident as an opportunity to put across the case for building modification without raising suspicion of my research interest. I updated the team, that the contractor had checked the building and suggested a couple of modifications that could be done in the short term. I reasoned with the team that the existing

building is old, awaiting general maintenance and suggested, “Isn’t it better for us to finish the modifications suggested in one shot? Choosing a period when you are not the busiest.” To this there was unanimous consensus in going ahead with the modification work and discussions in the group veered to finding convenient timelines. I also used humor while communicating with employees, to enable them make sense as they might struggle to find meaning in the intervention (Luscher and Lewis, 2008); “May be we should all reduce our weight to not strain our poor building...anyway a chance now to make it prettier than Kareena... What say”

For initiating the intervention during a separate routine meeting, I requested the participants to use the back door to enter the training building while the construction was in progress. As only the front side of the building was modified and construction area was cordoned off during the two weeks of renovation, there was no interruption or modification in the employee work routines.

#### **3.3.2.4 Designing the building intervention 13**

As the study organization is located in Bangalore, I utilized the principles of the local vernacular architecture called vedic architecture or vastu to humanize the building. Based on recommendations from the vastu consultant and indications from literature, position of the main entrance into the facility was highlighted as a major concern (Kannan and Jani, 2010; Kannan and Jani, 2013; Goodarzi and Fazeli, 2014; Das and Rampuria, 2015; O’Rourke, 2017; Pardeshi, 2017).

Accordingly, the building intervention was designed to change the position of the building entrance to the North East corner. In order to prevent potential participant questions upon a mere change in location of the entrance, I gave a face-lift to the front face of the building by adding a prefabricated non-functional façade to the building. This was done to give an impression that minor cracks seen in the front face of the building and voiced during the training meeting (see 3.3.2.3) had been addressed. There was no change or modification in work areas of the built environment as a result of this intervention. The intervention procedure is represented in Figure 3.6 and explained below:

Figure 3.6: Designing the building intervention

**A Pre-intervention building**

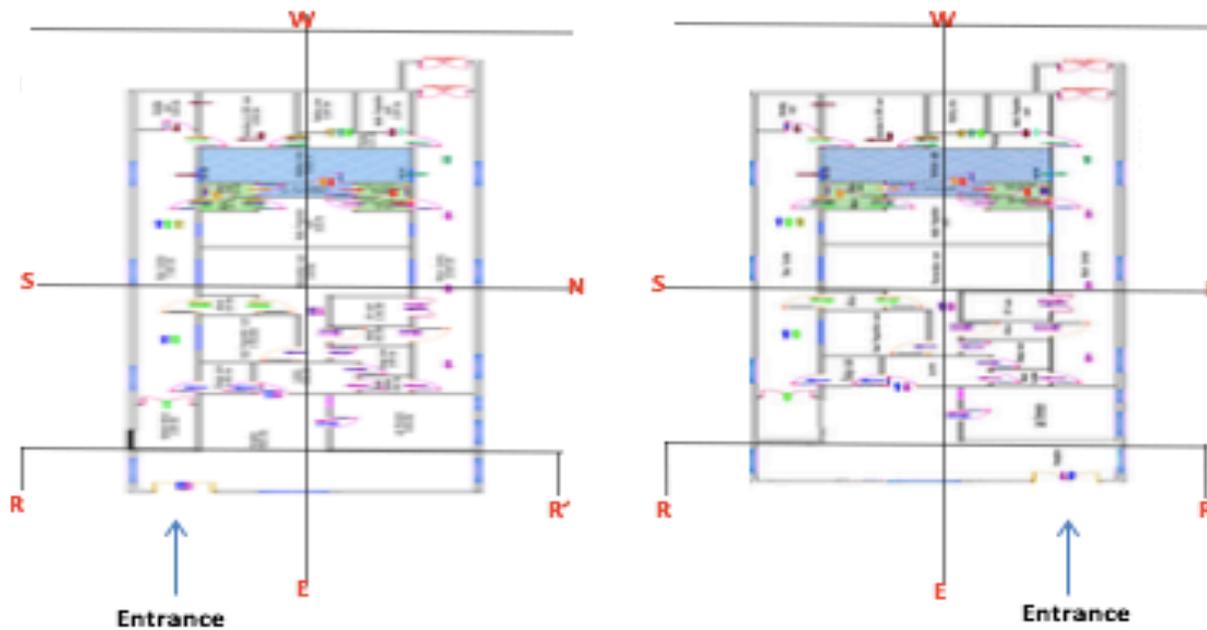


Front face of the building

**B Post-intervention building**



Front face of the building



Top view layout of the built environment

Post intervention, the entrance position was shifted from the South East quadrant to the North East quadrant as indicated. No other changes including windows, light sources, Air conditioner duct changes were made during the intervention.

N – North Direction  
 E – East Direction  
 S – South Direction  
 W – West Direction  
 RR' – Front section of the building depicted in the Top view layout. This forms the zone of intervention wherein the entrance door was relocated.

As illustrated in figure 3.6 above, geographic directions (North, South, West and East) were initially highlighted on the building plan after confirming them with an iPhone 6 compass. The existing main entrance in the South East quadrant of the pre-intervention building (see figure 3.6A) was then relocated to the North East quadrant after making an opening in the front wall (see RR' in figure) on the North East side of the building (see figure 3.6B). Upon relocating the entrance door, pre-intervention South East entrance location was closed with masonry and restored. To understand the significance of entrance position as underscored by Eastern architectural practices (see 2.6.2.2), care was taken to ensure that change in entrance position was the only effect as a result of this intervention procedure (see 3.3.2.5).

**Apparatus and Instrument:** The researcher should be able to translate built environments into the world of language for a clear narrative of the research. This can be achieved through photographs and drawings (Lebaree, 2013; Knight and Ruddock, 2009, p.18; Evans and McCoy, 1998; Purcell, 1987). Photographs were taken using an iPhone 6 camera in the afternoons on a non-working Saturday.

### **3.3.2.5 Assurance of Controls in the Built environment Intervention Design**

By drawing on the importance of controls in built environment research context (see 3.2.7.2), organizational influencers (see 3.2.7.1.1) within the training department were kept constant; with no changes in the reporting structure and power relationships during the intervention period that have been noted as a cause for discord and communication issues in workplace literature (Macphee, Wardrop, Campell, 2010). Further, to prevent the influence of confounding variables that have a psychological impact in the built environment identified factors relevant in the training building were kept constant during the study period (see Table 3.14). Intervention design thus aimed to obtain reasonable assurance that study outcomes were due to the architecture modification and not due to interplay of any confounding variables.

**Table 3.14 Built Environment Factors kept constant during the study period**

Factors in the workplace built		Pre-intervention Building (base status)	Post intervention Building	
Sensory Attributes	Climate	Temperature, Humidity, Air quality, ionisation	Position of the air ducts and air conditioner systems were not changed during the study period.	Remains the same as earlier.
	Interior Design	Lighting, Colour, sound, texture, space	Sources of Lighting, sound, texture and colour were kept constant. No addition of carpets and other artifacts were added, deleted or modified during the study.	Space in the non-habited non-working, front part of the building has changed.
	Ergonomics	Workstation, computers, furniture, workflow and layout	Computer systems, working positions, directions and orientations have not been changed during the study period. No additional furniture or layout changes were made.	Remains the same as earlier.
Built Infrastructure	Form	Structure, Utilities	Structure of the building and sources of utilities were not added, modified or enhanced during the study.	The aesthetic form of the building entrance has changed.
	Pollutants	Chemical, particulate, electromagnetic, noise	No equipment or pollution sources were added, modified or deleted during the study period.	Remains the same as earlier
	Ecology	Power sources, materials, water, waste disposal/recycling	No changes in electrical distributions or power points were made during the study. Load factor and recycling methods remained constant during the study.	Remains the same as earlier

Adapted from Clements – Croome (2000)

However, texture of space in a building envelope that was modified through the intervention has the ability to modify light, air, sound and energy properties (Clements – Croome, 2006). But modern understanding of built environment has dwelled on architectural elements such as ceiling height, natural light, colors and style as means to affect moods and emotions (Aoun, 2016). Since literature has demonstrated that number of windows and their size affect occupant mood through natural light penetration (Boubekri et al., 1991; Galasiu and Veitch, 2006; Gunay et al., 2013), they were controlled in the study by ensuring that position and size of the windows were the same before and after intervention. As only position of the entrance was shifted and no other addition or changes were made, it is reasonable to conclude that sound properties in the building would also have remained constant post intervention. Since the entrance door was merely relocated within the same planar surface, area of the entrance opening remained exactly similar post intervention. Thus, air movement can also be assumed to be similar to the pre-intervention state. Since the direction that one faces at work can affect moods and productivity (Bunn, 2012), sitting position, layout, direction of the desks or working orientation was not changed during the study period.

In addition to controlling elements in the built environment, services and maintenance protocols such as housekeeping and cleaning regimens within the building have also been shown to affect occupant wellbeing. To understand and control the effect of built environment descriptors, I used a method of analysis based on categories developed for building quality assessment (Clements-Croome, 2003; Williams, 2002; Saaty 1972). This framework (see Table 3.15) created cognizance of building factor interactions and was used to compare pre and post intervention-building states to provide assurance that built environment descriptors were controlled in the study. Since all variables within the building that can influence occupant perceptions and human productivity have to be accounted for and kept constant in the study for it to be valid (Wargoeki et al., 1999), this microstudy attempts to understand and control all confounding variables in the intervention building.

**Table 3.15 Evaluation of built environment descriptors**

Building Descriptors	Pre-intervention Building	Post intervention Building	Possible Effect
Appearance of the building	Entrance together with the front face of the building was refurbished. No changes were made to other parts of the building.		Aesthetic improvement. Sufficient time of study was means to counter the possible transient Halo effect.
Orientation of spaces and functionality in the workplace	Remained constant throughout the period of the study.		None
People Access within the department and inter-departments, social spaces, goods, reagents, storage compartments and positioning of general amenities.	Running stock of consumables, ease of access was not changed during the study period.		None
Amenities provided in the facility like canteen food	Suppliers of amenities in the organization remained the same during the study.		None
Support Services provided for the business like IT, power back up, speed of net connectivity.	Remained constant throughout the period of the study.		None
Working condition of employees, work timings, job design, responsibilities, time idling – workload	Remained constant throughout the period of the study.		None
Environmental, Health and Safety Procedures practiced	Remained constant throughout the period of the study.		None
Building structure and Condition	Entrance together with the front face of the building was refurbished. No changes were made to other parts of the building.		Aesthetic improvement. Sufficient time of study was means to counter the possible transient Halo effect.
Building operations – Housekeeping, maintenance schedules etc.	Suppliers of amenities in the organization remained the same during the study.		None

### **3.3.2.6 Post intervention Data Collection I4**

Data collection procedures adopted prior to the intervention were continued for 11 months post intervention. This data, comparison with pre-intervention data and emergent themes are explained in the section under study findings (see 4.0).

### **3.3.2.7 Summary of the Intervention study and Implementation roadmap**

This single component intervention study (Eldh and Wallin, 2015) focused on the change in spatial orientation of the entrance to comply with the rules of Eastern architectural practices. Besides possible advantages to the training division, this pilot study could serve to confirm advantages with Eastern architectural practices before embarking on a new green field built environment construction to meet the study purpose (see 1.1). Implementing the intervention was a multifaceted journey over an extended timeline with data points from different sources, engagement with domain experts, stakeholders and participants, and simultaneous efforts to control confounding variables in the built environment. This complexity necessitates the need to summarize the built environment intervention (Coghill et al., 2015) to enable a fuller comprehension of the intervention development and execution trajectory (Gitlin, 2013).

As the intervention aims to address the underlying affect and productivity in the training division (see 1.1.5) through incorporating suggestions from Eastern built environment literature (see 2.5), focus of the intervention dwells on transformation of the training built environment. To unpack the steps adopted during the intervention process, mapping was done through outlining the main steps and tasks in intervention development and implementation (Adelman and Taylor, 1994, p.60; Hartley et al., 2019) in table 3.16 below.

**Table 3.16: Steps and Tasks in the Intervention study**

<b>Steps in Intervention study</b>	<b>Tasks that apply to each step</b>	<b>Reference in the thesis</b>
Recognize the problem	Purpose of the research	1.1
	Identify project goal	1.1.5
Analyze the problem and identify factors that can be modified	Relevant literature review	2.6.2
	Meeting with consultants	3.2.3.3
Generate possible solutions to test and decide on mechanism of change	Shortlisting the intervention study building	3.2.4
Clarify ways to carry out delivery of change	Execution time for building renovation	3.2.5.1
	Determine ideal duration for data collection	3.2.6
	Controls in the study	3.3.2.5
Adapt and streamline the intervention processes to local circumstances	Capture existing organization schedule background	3.2.1
	Introduction of the research study to HOD's	3.3.1.2
	Prospective Participant Selection	3.3.1.3
	Pre-work before participant briefing to blind the study	3.3.1.4
	Invitation to prospective participants	3.3.1.5
	Consent forms and participation	3.3.1.6
	Participants in the study	3.3.1.7
	Participant debriefing on research Protocol	3.3.1.8
Implement the Intervention	Intervention Study setting	3.3.2.1
	Intervention briefing and scheduling building renovation	3.3.2.3
	Designing the building intervention	3.3.2.4
	Assurance of controls in the built environment during implementation	3.3.2.5
Collect evidence for effectiveness	Pre-intervention data collection	3.3.2.2
	Post-intervention data collection	3.3.2.6
Evaluate Outcome	Intervention Study Findings	4.2

Source: Compiled for the study

### **3.3.3 Developmental Study D0**

This study aims to incorporate Eastern architectural principles from the intervention study and literature review to synthesize an integrated model for the holistic design of a new workplace built environment. To synthesize an integrated model, Carroll et al. (2013) suggests the review of published models as a starting step. Accordingly, before embarking on the developmental study, models of built environment design, construction and sustainability were reviewed (Kajikawa et al., 2011). However, there were limitations in the comprehensiveness of the design guidelines and applicability to purpose of the studied organization (Kajikawa et al., 2011). Lack of adaption to characteristics of the local geographic region and associated cost implications were another prohibiting factors in applying these models (Issa et al., 2010; Gebken et al., 2009).

Therefore, to assist the organization to build a workplace environment for success, the preliminary framework proposed in this thesis and implemented through the developmental study integrates functional focus of Western architectural design with psychological aspects of Eastern architectural design. Drawing in from the positive psychological influences noted in the intervention study, benefits of this combination framework in building a new workplace built environment is ascertained using empirical evidence with the aim of enabling new approaches for competitive advantage and assisting possible explanations.

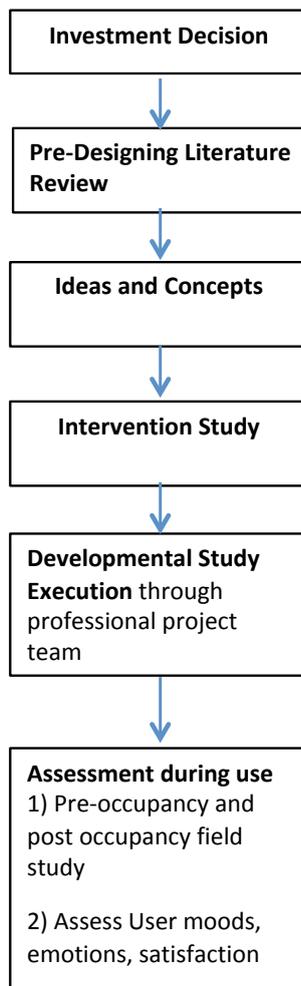
This approach fits into the existing trend of built environment research known as “research by design and design by research” (Fross and Sempruch, 2015). To construct the new building, the developmental study integrates existing design practices and attempts to benefit from built environment psychological aspects noted in literature. This is realized using a combination of vedic architecture design approach suitable for local Indian conditions, contemporary design practices from architects and concepts in environmental psychology.

To design the building, basic orientations, positions, placements and directions were laid out in consultation with the vastu consultant and literature sources. This configuration was conveyed to the architects as an essential requirement to support the business operations. The architects then used this outline to design the built environment. During the routine design review stages with the architect and his team, I ensured that proven and relevant environmental psychology concepts from literature were incorporated into the basic design.

Once the design was completed, the contractor constructed the building after receiving the necessary approvals from local civic authorities (see Figure 3.8 for the step by step approach to the green field built environment design). After completing the built environment construction, I extended the study into a post occupancy data collection, using observations and evaluations to justify design decisions (Fross and Sempruch, 2015).

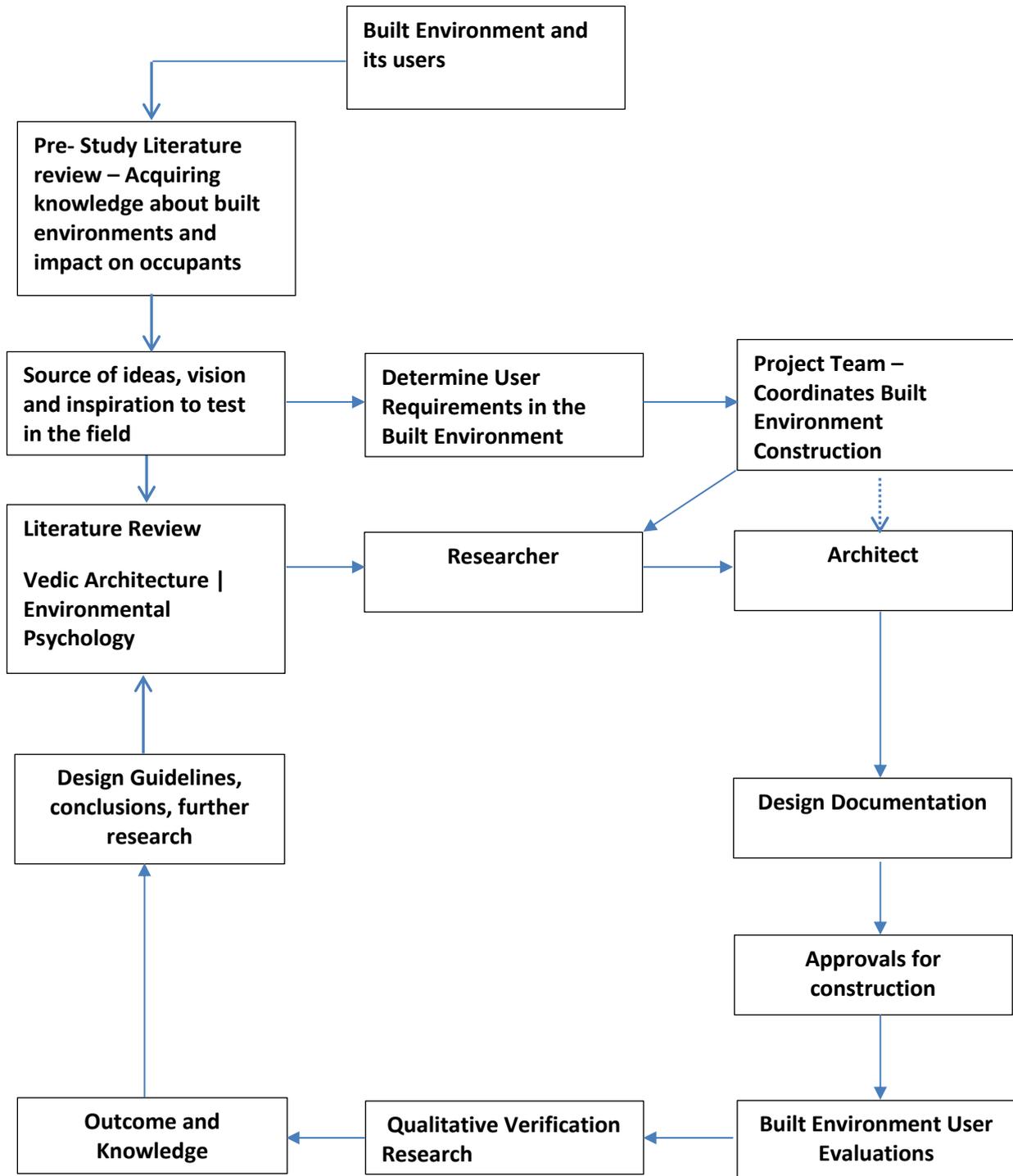
Design for the developmental study with inputs from intervention study was modeled as shown in Figure 3.7. Upon noting benefits of adopting Eastern architectural practices through the intervention study, green field built environment was designed with the use of research (see Figure 3.8).

**Figure 3.7: Positioning Developmental study within the research process**



Source: Compiled for the study

**Figure 3.8: Approach to Built Environment Design with use of Research**



Source: Adapted for this study purpose from Fross and Sempruch, 2015

### **3.3.3.1 Developmental Study Setting**

This study aims to determine the effect of a newly designed green field building on occupant mood, emotion and behavior. This was done by observing 9 participants in the old built environment of the manufacturing division and the changes that ensued while they relocated to the new facility. With 22 months in the field, data collection period was in line with suggested duration in built environment research (See 3.2.6).

### **3.3.3.2 Pre-Developmental Data Collection in the existing old building D1**

Nine participants in the manufacturing division were observed in the preexisting built environment for 10 months since the start of the Intervention field study. Pre-developmental and Pre-intervention data collection started together at the same time. The pre-developmental study continued until completion of the new building as part of the ethnographic approach to reviewing prevalent occupant affect and behaviors (see 3.3.4). The developmental study participants followed the same research routines as that of the intervention study participants (See 3.3.1.8).

### **3.3.3.3 Designing the New Building with Integrated Design Framework D2**

Variables in the built environment known to have a positive psychological impact on occupants (See 2.2.1.1) and concepts to humanize the building through Eastern architectural practices (See 2.6.2.1 and 2.6.2.2) have been adopted in the greenfield building through the Integrated Design framework (see Table 3.17) developed through this study.

According to Boaz and Ashby (2003), impact on research practice will be minimal if researchers use existing standards and processes. Therefore, to increase impact, I produced an amalgamated framework after a systematic review of literature (Gough et al., 2017, p.78, 189). When an issue is complex and has no directly applicable conceptual framework, amalgamating pre-existing theories (Ram et al., 2008) is considered the ‘best fit’ in such situations (Carroll et al., 2013). Hence based on the literature review, an integrative theoretical framework (Cane et al., 2012) that incorporates concepts in environmental psychology and Eastern architectural principles was developed for built environment construction in India. As prescribed by Booth and Carroll (2015) while combining theories to build actionable knowledge, the background and narrative to developing this model has been elucidated in this thesis. This framework thus complemented the conventional design approach adopted by architects and is illustrated below (Table 3.17):

**Table 3.17 Integrated Design framework**

<b>Discipline</b>	<b>Built Environment Factors</b>	<b>Suggested Guidelines</b>
<b>Environmental Psychology</b>	Light	Use light without flicker and glare with an illumination of about 400 lux suitable for a task at hand.
	Noise	Limit noise to 85 dB by using sound absorbing materials and equipment with low noise emission.
	Temperature	Arrest upper temperature limit to 30 °C with air movement in a warm and humid climate.
	Ventilation	Ensure proper ventilation with air movement.
	Furniture	Worktables and their spaces should be ergonomically designed
	Space	Avoid high people density and cramped equipment in the work areas.
	Control	Maximize individual control over built environment elements.
	Natural Daylight	Increase natural light through windows and skylight if available.
	Indoor plants	Position indoor plants
	Smell and fragrances	Avoid sources of bad odor near working areas.
	Color	Lighter colors and shades of white, blue and green
<b>Humanizing the Built Environment</b>	Shape of the built environment	Square or rectangular
	Position of Entrances	Main entrance – Northeast Secondary entrances – Zone of exalted energies
	Weight Distribution	Position heavy equipment in the South, West and heaviest equipment in Southwest. The North and East directions should be positioned with lighter equipment.
	Spatial arrangement	Position heat emitting sources in the South East quadrant, water sources in the Northeast and finished goods dispatch from the Northwest quadrant.
<b>Align contemporary Built environment design and construction practices with above guidelines</b>		

### **3.3.3.4 Applying Integrated Design Framework to new and existing buildings**

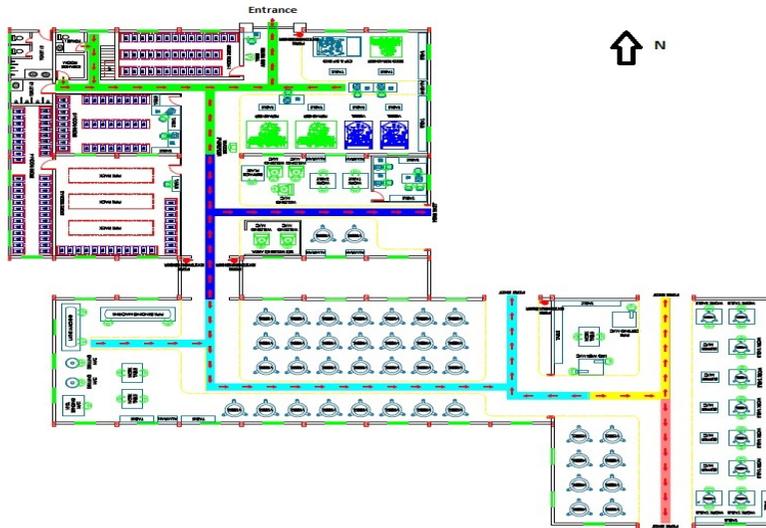
In order to attribute occupant changes if any to the changed circumstances of the new built environment constructed through Integrated Design framework (see Table 3.17), care was taken to ensure that study design maintained constancy of confounding variables in the organization that had the ability to affect occupant mood, attitudes and behaviors (see 3.2.7).

Model based analysis and testing depends on their content (Gebizli et al., 2016). Therefore, to evaluate benefits of applying the integrated design model to the green field built environment, differences between the new and old built environment design parameters were noted as shown in Figure 3.9 and at Table 3.18.

As outlined below, existing production building designed according to modern architectural concepts was furnished with environmental psychology driven built environment factors for positive occupant wellbeing. However, it was not humanized for built environment psychological benefits in accordance with principles of Eastern architectural practices.

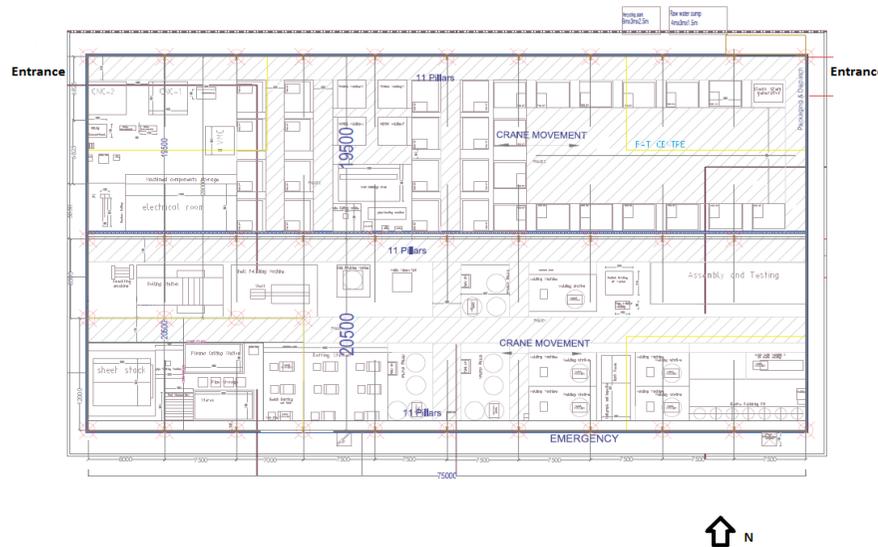
On the other hand, the new production building maintained constant environmental psychology factors (light, noise, temperature, ventilation, furniture, daylight, smell, colour) identified in the old building (see Table 3.18). In addition, Eastern architectural concepts that positively influence psychological aspects were incorporated through applying the integrated design framework derived from literature. New production built environment was thus designed with humanization principles from Eastern architectural practices that focus on building shape, position of entrances, spatial arrangement of elements and weight distribution (see 2.6.2.2). This conceptual basis of spatial arrangement in the built environment for positive psychological benefit is not highlighted in modern architectural practice.

**Figure 3.9: Architectural drawings of existing and new production built environments**



**Existing Built Environment**

- Irregular Shape
- Main entrance in the North west quadrant of the built environment
- Ad hoc position of secondary entrances
- No weight distribution schemes practiced in the factory layout
- Functions are not spatially arranged into specific zones



**New Built Environment**

- Rectangular shape and oriented along cardinal directions
- Main entrance in the North East quadrant of the built environment
- Secondary entrances positioned in the zones of exalted energies
- Weight distribution with lighter North and East zones
- Functions and utilities spatially arranged

**Table 3.18 Comparison of the integrated design framework compliance in existing and new built environment**

<b>Discipline</b>	<b>Built Environment Factors</b>	<b>Suggested Guidelines</b>	<b>Existing Factory built environment</b>	<b>New Green field Factory built environment</b>
<b>Environmental Psychology</b>	Light	Use light without flicker and glare with an illumination of about 400 lux suitable for a task at hand.	Production floor well-lit through artificial flicker free electric lighting. Specific areas that that require greater illumination provided with focus lights.	As before
	Noise	Limit noise to 85 dB by using sound absorbing materials and equipment with low noise emission.	Maximum noise emission was limited to 75 dB by using enhanced sound absorbing materials and equipment with low noise emission.	As before
	Temperature	Arrest upper temperature limit to 30 °C with air movement in a warm and humid climate.	Maximum indoor temperature restricted to 28 °C with cooling towers and ventilation systems.	As before
	Ventilation	Ensure proper ventilation with air movement.	Proper ventilation maintained through roof based ventilation ducts, mist fans, air purifiers and need based air conditioning.	As before
	Furniture	Worktables and their spaces should be ergonomically designed	Worktables and their spaces are ergonomically designed.	As before
	Space	Avoid high people density and cramped equipment in work areas.	Individuals and other equipment are well spaced out to avoid crowding.	As before
	Control	Maximize individual control over built environment elements.	Individual control of light, airflow, equipment, Noise emission.	As before
	Natural Daylight	Increase natural light through windows and skylight if available.	Well-lit production floor through artificial electric lighting. Daylight complemented electric lighting.	As before
	Indoor plants	Position indoor plants	No Indoor plants.	As before
	Smell and fragrances	Avoid sources of bad odor near working areas.	No bad odor near working areas with their emission sources situated far away.	As before
Color	Lighter colors and shades of white, blue and green	Lighter colored interiors with shades of white and green.	As before	

<b>Discipline</b>	<b>Built Environment Factors</b>	<b>Suggested Guidelines</b>	<b>Existing Factory built environment</b>	<b>New Green field Factory built environment</b>
<b>Humanizing the Built Environment</b>	Building Shape	Square or rectangular	Irregular shaped building.	Rectangular shaped building.
	Position of Entrances	Main entrance – position in Northeast. Secondary entrances – position in the zone of exalted energies	Main entrance is positioned in a neutral energy zone. Secondary entrances are positioned according to convenience	Main entrance is positioned in the Northeast positive energy zone. Secondary entrances positioned in the zone of exalted energies
	Weight Distribution	Position heavy equipment in the South, West and heaviest equipment in Southwest. The North and East directions should be positioned with lighter equipment.	Equipment's are positioned on an ad hoc, ease of access and convenience basis. This approach resulted in heavy equipment being positioned in the North and East sides.	Workspace was designed such that heaviest equipment's were positioned in the southwest and heavy equipment's were positioned in the South and West sides. North and East sides of the built environment were kept more open and positioned with lighter equipment.
	Spatial arrangement	Position heat emitting sources in the South East quadrant, water emitting sources in the Northeast and finished goods dispatch from the Northwest quadrant.	Utilities and equipment were positioned to optimize costs and increase convenience. Consequently, Generators and heat sources were in the North East, water generating sources in the North West and goods storage was in the Southwest.	Heat emitting sources were positioned in the South East quadrant, water generating sources in the Northeast and finished goods dispatch from the Northwest quadrant.

### **3.3.3.5 Post occupancy Data Collection of new Building D3**

Data collection procedures adopted in the intervention and pre-developmental studies were continued for a year post the new built environment occupation. Emergent themes, behaviors and moods of occupants in the two built environments were subsequently analyzed and have been presented under study findings (see 4.0).

### **3.3.3.6 Summary of Developmental study and Implementation roadmap**

This study draws in learnings from literature and benefits noted in the intervention study after implementing Eastern architectural practices in the training built environment. To meet the study purpose (see 1.1.5), developmental study was structured soon after noting positive benefits with the intervention study. This mitigated organizational risk and enhanced confidence into implementing the proposed Integrated design model for the study.

Developmental study adopts a multifaceted intervention approach (Eldh and Wallin, 2015) based on the integrated design framework proposed in this study (see table 3.17). By leveraging advances in modern sciences such as environmental psychology along with principles in Eastern architectural practices, it was envisaged that a hybrid approach will enable a holistic design of the green field built environment. Designing the proposed framework required wide consultations with literature and domain experts. Subsequent designing and construction of the built environment adopted an implementation approach with use of research (see Figure 3.8). This involved multiple stakeholder interactions amidst concurrent efforts to identify and monitor comparative environment variables between the existing built environment and new greenfield built environment (see table 3.18). To enable a fuller understanding of the development and implementation trajectory, main steps and tasks adopted during the developmental study (Adelman and Taylor, 1994, p.60; Hartley et al., 2019) have been summarized (Coghill et al., 2015) and outlined in table 3.19 below.

**Table 3.19: Steps and Tasks in the Developmental study**

<b>Steps in Developmental study</b>	<b>Tasks that apply to each step</b>	<b>References in the thesis</b>
Recognize the problem	Purpose of the research	1.1
	Identify project goal	1.1.5
Analyze the problem and identify ambient factors that needs to be incorporated	Literature review	2.0
	Meeting with consultants	3.2.3
Test possible solution with pilot study and check feasibility of implementation	Intervention study	3.3.2
Clarify ways to carry out delivery of new built environment design	Execution time for new built environment	3.2.5.2
	Determine duration for data collection	3.2.6
	Understand confounding variables	3.2.7
Adapt and streamline the intervention processes to local circumstances	Capture existing organization schedule background	3.2.1
	Introduction of the research study to HOD's	3.3.1.2
	Prospective Participant Selection	3.3.1.3
	Pre-work before participant briefing to blind the study	3.3.1.4
	Invitation to prospective participants	3.3.1.5
	Consent forms and participation	3.3.1.6
	Participants in the study	3.3.1.7
	Participant debriefing on research Protocol	3.3.1.8
Implement the hybrid approach that blends advances in Environmental psychology with rules in Eastern architectural practices	Developmental Study setting	3.3.3.1
	Constitute devoted developmental team	3.2.3.1, A4
	Introduce Eastern consultant after blinding his background	3.2.5.2
	Researcher ensures incorporation of concepts from literature review	3.3.3
	Design new building with Integrated Design Framework	3.3.3.3
	Assurance of controls through comparison of design variables between old and new built environments	3.3.3.4, Table 3.18
Collect evidence for effectiveness	Pre-Developmental data collection	3.3.3.2
	Post-Developmental data collection	3.3.3.5
Evaluate Outcome	Developmental Study Findings	4.7

Source: Compiled for the study

### 3.3.4 Data Collection Approach

In a scholarly practitioner approach, perspectives have to be understood from several participants by imposing minimal structure on capturing the experience (Aram and Salipante, 2003). I as a researcher worked in the organization under study, shared work routines with the study population, kept the research intention “deliberately vague” during research interactions (Veitch and Newsham, 1998) and conducted research in the background of daily operations to prevent participant bias (Maxwell, 2012, p.124; Lewis, 2009). I avoided obvious routine changes during the research and facilitated regular formal and informal interactions (Greene, 2014) during weekly team meetings, co-working, debriefing sessions, spontaneous and courtesy conversations, and individual face to face employee meetings.

To determine impact of the built environment on mood, emotion and occupant behavior, I used established qualitative research methods (Yin, 2015) such as observation, face-to-face interaction (Interviewing) and report analysis (Denzin and Lincoln, 2011, p.14). I also urged participants to maintain daily logs of their wellbeing during the day, as solicited participant diaries are an excellent source of data in qualitative research (Jacelon and Imperio, 2005) that reduces participant’s recall bias while recounting happiness states, mood changes and health conditions in every day workplace life (Chan et.al, 2015). When participant diaries are combined with interviews, they provide a rich account of day-to-day activities of participants (Jacelon and Imperio, 2005).

Therefore, primary data from the field was collected through ethnographic approaches that included participant observation, reflection and journaling in my first person inquiry (Reason and Torbert, 2001). This data was captured and generated through a daily log modeled on the lines of Schein’s ORJI (Observation, Reaction, Judgment, Intervention) journal (Coghlan and Brannick, 2014). Besides helping me to understand the situation, this log also facilitated meta-learning through reflective commentary that is critical in establishing credibility (Guba and Lincoln, 1989). The record of these participant incidences served as sources of reflection during face to face interactions with participants and while discussing their respective participant diaries. The recorded information in participant diaries were further elaborated and understood through second person collaborative inquiry (Reason and Bradbury, 2001, p.253). Confrontive inquiry (Coghlan and Shani, 2005) measures were also used during these interactions.

My daily first person log collected as an insider researcher was then supplemented with information arising from collaborative inquiry using participant dairies. Checking the information with participants help accurately capture field data (Guba and Lincoln, 1989) and ascertain researcher inferences (Miles and Huberman, 1994; Brewer and Hunter, 1989; Pitts, 1995). As Van Maanen (1979) advocates data verification in the field itself, verified information was filled into my daily log before venturing into other activities.

In order to gain a true picture of reality, I oriented the data collection strategy around the concept of “circling reality”, that is defined by Dervin (1977) as “the necessity of obtaining a variety of perspectives in order to get a better, more stable view of ‘reality’ based on a wide spectrum of observations from a wide base of points in time-space”. Therefore, a wide range of non-participant experiences including those of administrative, housekeeping, human resource departments and site contractors were captured to yield a rich picture of attitudes and behavior of the study participants, and to enhance contextual data (Van Maanen, 1979; Shenton, 2004). To promote contribution from all participants, I often mentioned, “a research will have no right or wrong answers and that seemingly silly comments have changed the world”. Periodic face-to-face interactions also allowed me to elicit participant views, despite personal characteristics such as being quiet and inarticulate. I also gave sufficient time during interactions and nudged participants to continue their thinking with positive comments such as “that’s a great idea. What may be the reason that you had this thought?”

To support my cognition, I consolidated my reflections in the daily logs and maintained a monthly reflection report based on Kolb’s experiential learning theory (Coghlan and Brannick, 2014). Monthly reflection reports contained generalizations of daily observations for the month, reflections, trends and emergent themes. The reflections in these monthly reports contributed to scholarly practice, with increased understanding of the situation and of the phenomenon being studied (Stenbacka, 2001).

Since using different data collection methods together will exploit respective benefits and compensate individual study method limitations (Brewer and Hunter 1989; Guba, 1981), themes emerging from different data sources were then triangulated with a range of relevant office documents (Shenton, 2004) to test validity through information convergence (Carter et al., 2014) and to confirm my perceptions arrived through discussion with participants (Greene, 2014).

### 3.3.4.1 Measures for mood and emotion

Moods and emotions were measured through participant self-reporting, observation of smiles and productive behaviours.

- **Self-reporting:** An individual's self-reported levels of happiness and perceived levels of satisfaction is a dependable measure of wellbeing and positive emotions (Theron, 2006). In line with past built environment literature studies, I provided a four point scale format for self-reporting. The anchors in the scale were 1 = very good, 2 = good, 3= bad, and 4 = very bad. I dropped the midpoint option from the scale to encourage realizations between positive and negative feelings (Rofe and Weinreb, 2013) and to reduce the possibility for response biases, as people in Asia with a more collectivistic orientation are likely to respond on the basis of community norms of maintaining status quo (Lee et al., 2002). As addition to an existing workplace routine can sustain the exercise over a longer period, ensure better compliance and reduce research fatigue (Clark, 2008), participants were encouraged to fill self-report logs along with daily time sheets that they routinely filled at the organization.
- **Observation of smiles:** Positive mood can be measured by observing the activity of “smile muscles” in the face (Gilbert, 2012). Expression of Duchenne smile (smile that raises the corners of the mouth and raises the cheeks) relates to happiness and positive emotions in humans (Dimberg, Thunberg, and Elmehed, 2000). “Then if interviews and self-reports corroborate the positive effects, this is evidence for long term or secondary effects on mood” (Haviland-Jones et al., 2005). As facial muscles can be discerned by untrained people and is easy to recognize when embedded in ongoing activities (Haviland-Jones et al., 2005), I noted them in the daily log upon observation. Observation of smile was often followed by spontaneous conversations and discussions with the researcher (Fross and Sempruch, 2015).
- **Observation of Productive behaviours:** Based on the study of Tsai et al. (2007) to determine the impact of positive mood on task performance, I observed instances of task persistence, self-efficacy, self-rated goal attainment, helping other co-workers, co-worker helping and support within participant activities.

### 3.3.4.2 Secondary Data collection

To develop a more comprehensive understanding of the phenomena being studied (Carter et al., 2014), I used different sources of relevant organizational secondary information (Hox and Boeije, 2005) such as:

- **Time spent at work voluntarily:** Haviland-Jones et al., (2005) states that “Long term expression of positive moods leads to a prolonged involvement in an ongoing activity.” “Motivated people seek more hours of work, not fewer” (Herzberg, 2010). Hence to sense increased work involvement, participant time sheet data was analyzed to determine the time spent at work.
- **Absenteeism:** Absenteeism reports separated out due to illness and maternity leave are commonly used to measure building productivity (Heerwagen, 2000; Heerwagen and Wise, 1998; Montgomery et al., 1994).
- **Business volumes:** Positive mood and emotions have an impact on job performance and drives behavior that are integral to success and organization performance. Positive mood drives teamwork as people are “mood conductors” and influence others in the workplace positively (Barsade and Gibson, 2007). To determine the impact on overall division performance, revenue changes pre and post interventions were noted.

As positive moods have been directly associated with work productivity (Tsai et al., 2007), routine effectiveness measures such as customer feedbacks, appraisals and key result area target achievements were collected from the organization for data triangulation with the field observations. These data points were then summarized into monthly reflection reports and analyzed alongside the thematic analysis of primary field data.

### 3.3.4.3 Data Sources in the study

During the course of the study that lasted 22 months, I systematically collected primary data of my observations recorded in daily logs (513 work days and 433.5 hours of co-working); participant data from participant logs (9745 self-reports); enriched my awareness with regular interviews (518 Hours of interview) and consolidated them into monthly reflection reports. I then checked the validity of the findings with archival data.

**1) Participant Observations:** During the study period, I practiced persistent participant observation (Guba, 1981) and focusing in detail (Greene, 2014) to understand participant interests, attitudes, engagement patterns, emotions and team spirit that can be attributed to changes in the built environment. As an individual working in the organization, I had the opportunity to observe the participants in the real work setting and co-work alongside the participants in conducting experiments and other departmental work. I also observed their individual body language and smiles during meetings and social occasions. I paid particular attention to intra-team interactions at work and during meetings to observe productive behaviors. Alongside these aspects, I also noted dressing appearance, posture and emotional energy of participants. To gauge emotional energy, I used suggestions from Orloff (2017):

- I attempted to sense the effect of people's presence by asking myself, "Do they have a friendly presence that attracts?" Or are they making others back off.
- Watched people's demeanor – "Are they Caring? Mean? Angry? Do they seem guarded or hiding while interacting?"
- Listened to participant's tone of voice – Does the participant interaction feel soothing or is it abrasive, whiny or snippy?
- Noticed physical contacts like handshakes and gentle touches – Were they inspiring, motivating, non-committal, warm, comfortable, confident or timid?

Comments by non-participants on participant behavior that became apparent during casual conversations were also recorded in my daily log (Appendix 5).

**2) Participant Self-reporting:** Participants were requested to record their sense of well-being on every working day. Participants maintained their own individual personal record during period of the study (Appendix 3). The 23 study participants were identified by a code to maintain confidentiality and to avoid attributing quotes to the participant (Appendix 4).

Individual data from every participant was then compiled into a consolidated daily participant report for tracking and easy reference (Appendix 6). Participant self-reports and my daily research logs together provided inputs for one to one interview to further my understanding of the situation.

**3) Interviews:** To corroborate my observations with participant thoughts, and to gain further insights into their feelings and work experiences, I used regular unstructured interviews to increase descriptive validity (Maxwell, 2012, p.171, 195). Collaborating with the participants will promote participant honesty and increase interpretive validity (Lewis, 2009). For regular interviewing, the 23 participants were divided across the days in a week (Appendix 4), such that every participant was interviewed at least once a week (Appendix 6).

Puebla, Faux & Mey (2004) suggests that qualitative interviews can be viewed as the democratization of interviewee's experience interpretations. In this study, the interviewing process did not seek to gain an understanding through a rigid question and answer format but allowed interviewees to bring forth information.

I began every interview by making sure that the participant was comfortable and at ease. The interviews typically began with broad positive questions such as "The weather is changing these days right... Is it raining these days at your native place as well?" As the interview progressed, like Dervin (1977), Chen and Herson (1982) amongst others, I sought information by inviting participants to reflect on the situation by asking questions such as "So how are you...how did you feel the way you have recorded your log", "Any reasons to feel so? You are a star right...something would have occurred to you perhaps?" I further sought clarifications on their respective participant logs and touched upon my daily log observation by asking relevant questions such as "You weren't happy with the AZ study progress?", "How were your colleagues?" Emergent themes in one interview were mentioned in subsequent interviews by using subtle probing and iterative questioning (Shenton, 2004) with prompts such as "some were saying a lack of energy or something like that often...Have you felt something like that?", "What may be the reason you feel that way?" Therefore, by returning to matters noted by other participants and informants in the data collection design, detailed data could be gathered and misrepresentation of facts could be detected (Shenton, 2004).

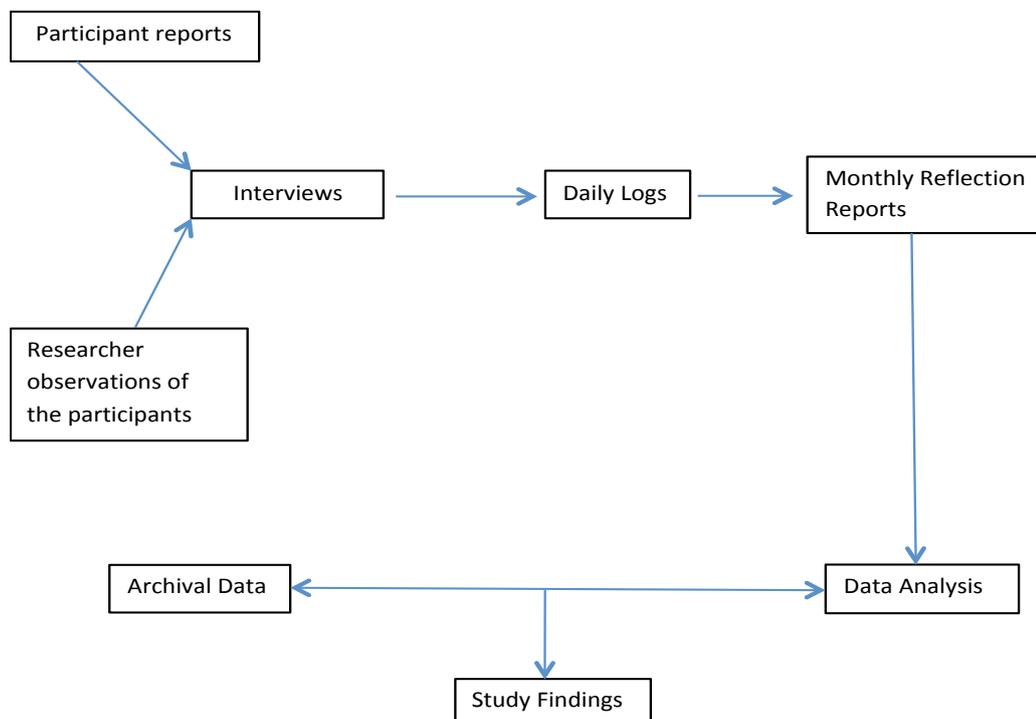
At times, I jotted down information that I wanted the participants to elaborate. This was done to prevent disruption to the flow of their narrative and to exercise caution against introduction

of participant bias (Creswell & Miller, 2000), when participants respond in a way they think the researcher wishes (Nichols et al., 2008). After each interview, my daily log was updated with additional information from the interviews.

**4) Researcher Diary:** The daily researcher log captured my observations during team meetings, while working together and during interviews. Team interactions, interest in finding a solution, peer diplomacy in resolving a situation and the number of Duchenne smiles from participants were particularly observed. Upon follow up conversation with the individual participant, further thoughts and background details were added in confirmation with the participant. My earlier views on participant observations were modified in accordance with the participant views to reflect participant opinions. Participant behaviours that come to light during casual conversations with other employees such as housekeepers, cleaning staff, security, and other departmental staff (Van Maanen, 1979; Shenton, 2004) were also noted in my daily log.

**5) Archival Data:** Secondary data (as explained in 3.3.2.2) was used to check the validity of my understanding of the situation.

**Figure 3.10: Data Sources processing in the Study**



Source: Compiled for the study

### 3.3.5 Data Analysis

Thematic analysis with qualitative rigor was done to identify patterns emerging from within the data (Braun and Clarke, 2006). This included reading and analyzing the data to assign codes and categories to identify emergent themes and trends in the data (Guest, MacQueen, Namey, 2012). Initial codes and categories were generated in a deductive manner during literature review of affect in the built environment. To understand the several emotional states noted during emotion detection in the built environment, I used the circumplex model of affect (Fernandez-Caballero et al., 2016; Knez and Hygge, 2002). This model includes six basic universal emotions of happiness, sadness, anger, disgust, fear and surprise; Degree of activation that can be categorized as active or inactive; and Degree of pleasantness or valence categorized through affects namely Bored, Excited, Relaxed and Nervous.

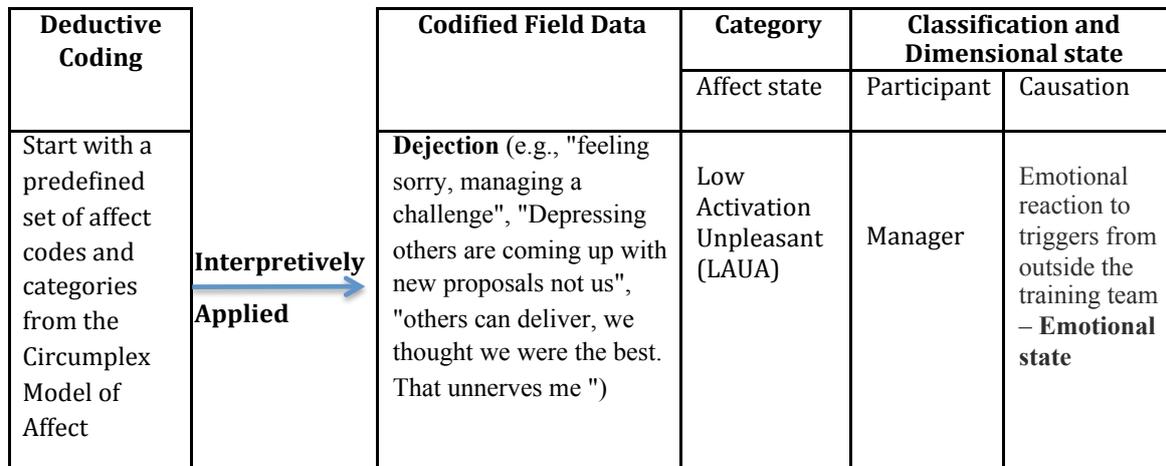
**Figure 3.11: The Circumplex Model of Affect**



Reference: Fernandez-Caballero et al., 2016).

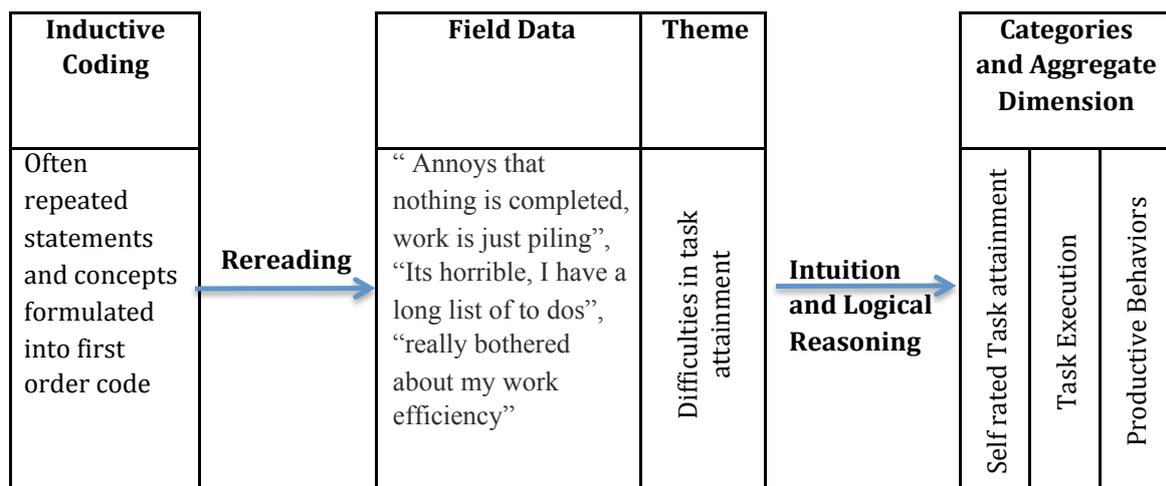
These predefined affect codes from the circumplex model of affect were then interpretively applied to the daily log as shown below and captured into reflection reports for sense making.

**Figure 3.12 Thematic Analysis: Deductive Coding of Affect**



New codes were also inductively generated during this exercise, as there was no attempt from my side to fit the data into identified codes. Thus, my coding also had an exploratory positioning as often-repeated participant statements and words were formulated into first order codes (Locke, 2001), and key emerging concepts were identified into theoretical categories and aggregate dimensions through the Gioia methodology (Gioia et al., 2013).

**Figure 3.13 Inductive Coding of Productive Behaviors**



The codes could have been influenced by my perceptions and inclinations. Due to the inductive nature of this analysis, I modified the codes and its allocation on rereading the data (Saldana, 2015) and used intuition and logical reasoning to categorize the codes (Lincoln and Guba, 1985 in Saldana, 2015). Initial preliminary data analysis occurred together with data collection. While analyzing through the thick description of participant driven data, I followed an iterative process of moving back and forth (Miles and Huberman, 1994; Strauss and Corbin, 1990) between data and theoretical observations established through the codes. I then organized the emerging themes into a coherent framework to add to the theory of built environment psychology. The coding process thus followed a constructionist paradigm as it was based on my interpretations. To demonstrate rigor in thematic analysis, I have included definition of codes, rules for allocation of codes and classifications (see table 3.21 and 3.22), and data coding with this thesis (Appendix 7).

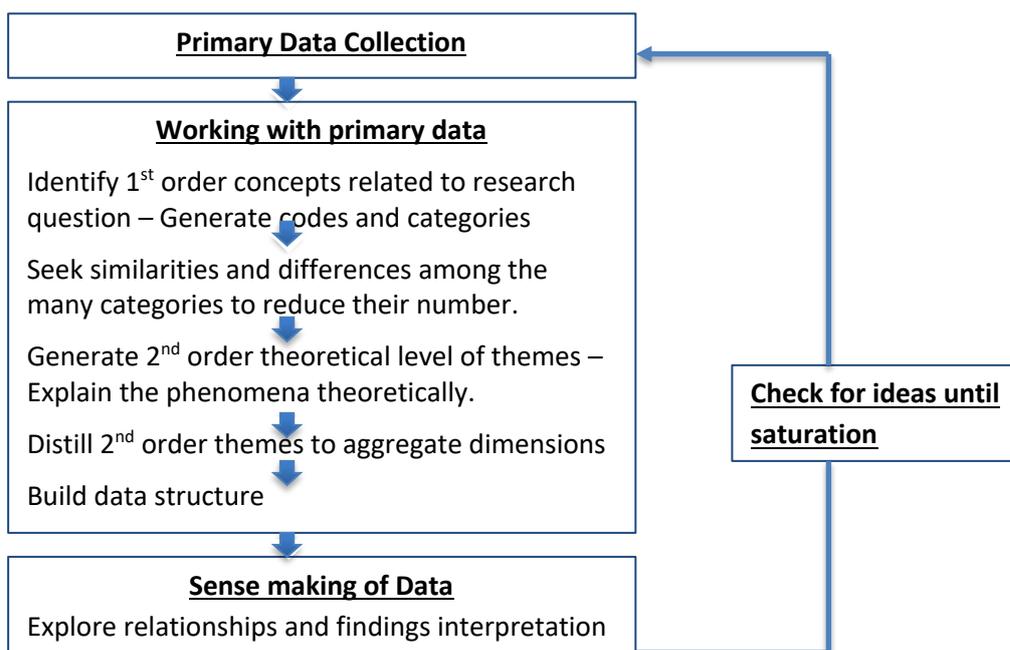
### **3.3.5.1 Movement from raw data to meaningful insights**

To ensure credible and defensible progression from raw data to emergent theory (see figure 3.14 below), I used the Gioia methodology (Gioia et al., 2013). Understanding of the phenomenon in inductive qualitative research involves sense making through reducing the captured raw information to pertinent data, followed by identifying themes and meaning from data, and subsequently building a chain of logical evidence to support the understanding (Patton, 2002). This process requires subdividing primary data into codes and subsequently allocating them into categories. Codifying will arrange primary data into a systematic order of grouping and categories to consolidate explanation and meaning (Saldana, 2015). Codes are often a word or short phrase that symbolically summarizes and captures the essence of visual or language based data (Saldana, 2015). Coding was initially done with colored markers to organize, summarize, categorize and sort the data. To represent participant voices prominently in the thesis, I have made efforts to give voice to the participants during data collection (see 3.3.4). Research conduct was guided to impose qualitative rigor (see 3.1.5) and findings have been presented in a way that demonstrates emerging concepts, connections among data and resulting grounded theory (see section 4). To represent participant and researcher voices and as suggested by Gioia et al., (2013), I have systematically represented 1<sup>st</sup>-order concept analysis using participant centric narratives (see Table 3.20 below), and a 2<sup>nd</sup>-order researcher centric analysis of themes and dimensions.

Early in the research, the 1<sup>st</sup>-order analysis that focused on participant and informant narratives opened up several categories and themes that initially did not seem to make sense. As the research progressed, I looked for similarities among emerging themes that eventually reduced the number of categories. I then reread the data to give labels to these categories that became first order codes. I then considered “What’s going on here?” and thought across multiple levels simultaneously to arrive at 2<sup>nd</sup>-order theoretical themes. As subsequent interviews focused on concepts emerging from interviews till date, data collection and analysis tended to proceed together. Once I had a set of themes and concepts, I investigated the possibility of distilling the 2<sup>nd</sup>-order emergent themes into aggregate dimensions. With the 1<sup>st</sup>-order concepts, 2<sup>nd</sup>-order themes and aggregate dimensions, I built a data structure (see figure 3.15 below) that graphically represents the progression from raw data to themes in conducting the analysis, which is an important part of demonstrating qualitative rigor (Gioia et al., 2013).

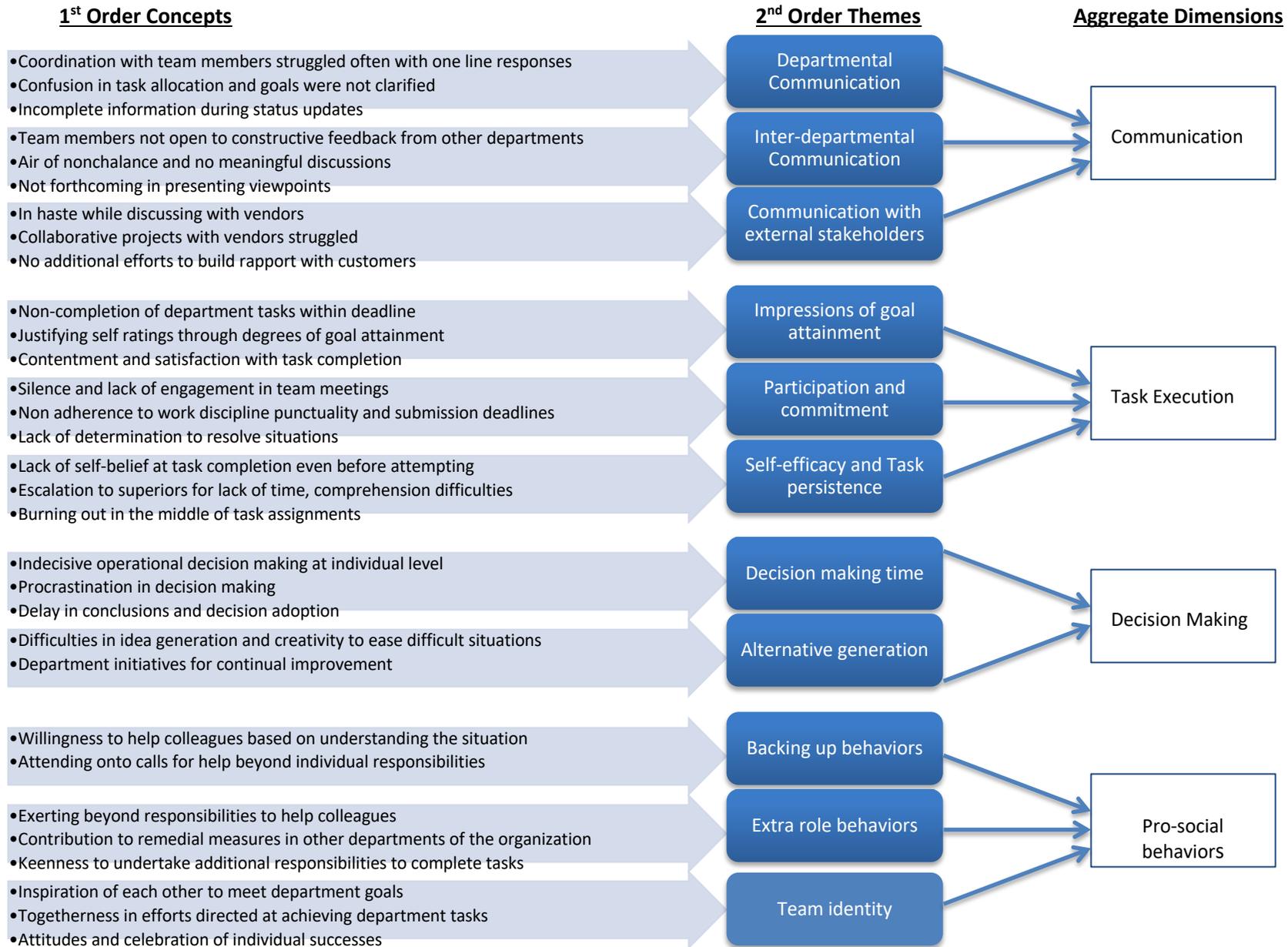
Data structure is then translated into grounded theory by showing dynamic relationships among the emerging themes. This theorizing process requires consulting the literature in tandem with the data in the form of an abductive research (Gioia et al., 2013). The discussion section in this thesis (see section 5) describes the grounded theory by transforming the static data structure into a dynamic inductive model to describe interrelationships in emerging data concepts; explains phenomenon of interest and clarifies relevant data to theory connections.

**Figure 3.14 Primary data to insights**



Reference: compiled for the study

**Figure 3.15 Data structure**



Reference: Adapted from Corley and Gioia, 2004

**Table 3.20: 1<sup>st</sup> Order Concept analysis from primary field data**

Representative primary data	1 <sup>st</sup> Order Concepts
<p><i>"Can you do this"</i> (Senior N), <i>"I have completed it"</i> (Junior W), <i>"s3 trials complete?"</i> (Manager K), <i>"technical offer make it better"</i> (Senior P)</p>	<p>Coordination with team members struggled often with one line responses</p>
<p><i>J expressed shock at seeing K and L presenting similar course modules. K in turn questions O and P and find out if the ongoing responsibility was communicated with M and N. O reasons that since the information was put up on the white board, it was taken for granted that M and N would have seen it as part of their respective responsibility and did not consider it necessary to discuss orally.</i> (Manager)</p>	<p>Confusion in task allocation and goals were not clarified</p>
<p><i>When the media stock was exhausted, the participant resorted to an alternative means to complete the experiment. Non-reporting of the issue however resulted in its non-availability for other priority experiments that were outside this participant's direct responsibility. Upon enquiring, I was informed by the participant, "Did not want to be held accountable for not ordering the media stock. Anything that I say will result in belittling of my capabilities"</i> (Senior Q)</p>	<p>Incomplete information during status updates</p>
<p><i>While discussing campus cleanliness, a production colleague pointed to the vegetative overgrowth near the training building, there was no reaction for a few seconds. The study participants then softly said, "We have not seen".</i> (Manager L)  <i>Similarly, when they raised concern on excessive boiler usage, the study participants murmured non-confidently, "this is needed for our operations. So how reduce".</i> (Manager K)  <i>When other Departmental HOD's raise possible concerns on the safety policies practiced by the contractor's workmen, Training HODs were silent, made no comments, showed no awareness and did not seem to be bothered.</i> (Manager)</p>	<p>Team members not open to constructive feedback from other departments</p>
<p><i>While discussing ways to tide over water constraints, training team members made no contribution and did not participate in discussion except nodding their heads.</i> (Manager and Seniors)</p>	<p>Air of nonchalance and no meaningful discussions</p>
<p><i>Today during the HOD meeting, all the non-training team members deliberated and wanted to adopt 5S. Work quantum, time utilizations and routine disruptions were discussed. The overall sentiment was to bear the hassle and go ahead with its implementation. Upon insisting the silent training team members to give a feedback they commented "Ahhh.. (silence) Its ok"</i> (Manager J)</p>	<p>Not forthcoming in presenting viewpoints</p>
<p><i>Body language did not look confident and firm. "Wanted to get done with the meeting fast"</i> (Senior R).</p>	<p>In haste while discussing with vendors</p>
<p><i>Training team members seemed inflexible and locked into an issue rather than solving it. "we should look for different valve suppliers. Acting very smart."</i> (Senior Q).</p>	<p>Collaborative projects with vendors struggled</p>
<p><i>A customer informed me about market information that was missed as a result of lack of proximity with the customer. "When a customer requested a technical answer, the research participant suggested that the customer use the formal queries portal rather than directly addressing the query".</i> (Senior P, Junior V)</p>	<p>No additional efforts to build rapport with customers</p>
<p><i>"review is taking time and we could not finalize the chrome configuration"</i> (Manager J)  <i>"I could not complete the turbidity parameters for manager review"</i> (Senior O)  <i>"Annoys that nothing is completed, work is just piling"</i> (Manager K),  <i>"Its horrible, I have a long list of to dos"</i> (Manager L),  <i>"really bothered about my work efficiency"</i> (Manger L)</p>	<p>Non-completion of department tasks within deadline</p>
<p><i>"I am ok, I finished my part of the work"</i> (Senior P with self rating 3, pre-intervention)</p>	<p>Justifying self ratings through degrees of goal attainment</p>

Representative primary data	1 <sup>st</sup> Order Concepts
<i>"couldn't finish the experimental CQA factor...will keep trying... it should be ok"</i> (Senior M with self rating 2, post-intervention)	
<i>"when the performance of juniors and seniors were criticized during the team meeting "What proof reading is it...I am sure second graders can do a better job"</i> (Manager K). <i>Upon successfully completing the eco audit, J stated "We did a good job and the team really supported...very happy"</i> (Manager J).	Contentment and satisfaction with task completion
<i>I observed a lack of interest and participation in meetings. Managers commented, "Lazy fellows, absolutely no interest or preparation", "zero solutions from the team"</i> (Manager)	Silence and lack of engagement in team meetings
<i>"Had K3 to complete - focused all my energies there"</i> (Senior P), <i>"sorry I am late, was stuck in traffic"</i> (Junior W), <i>"autos were less today"</i> (Junior T)	Non adherence to work discipline punctuality and submission deadlines
<i>"Had a lot of documentation to complete"</i> (Junior W), <i>"going through the entire bunch was not practical"</i> (Senior M) <i>"Can't stay back today"</i> (Junior T), <i>"feel under the weather"</i> (Junior W), <i>"sick and feverish"</i> (Senior N)	Lack of determination to resolve situations
<i>"I don't have the competency and I am failing on several occasions."</i> (Senior O), <i>"Short timelines scare me. I am not good in dealing with challenges"</i> (Junior S), <i>"It is a very difficult task and I am certain I will not accomplish it within the deadline", and "I will fail as I have in the past.... I am just not able to complete anything"</i> (Senior Q)	Lack of self-belief at task completion even before attempting
<i>"I tried calculating the kLa factor for the last 3 hours but failed"</i> (Junior T), <i>"It's been almost 4 hours since I have tried fixing the macros...should we look for a person who knows excel very well"</i> (Senior M), <i>"tried several times and I feel outsourcing the marcom brochures will give superior finish"</i> (Senior P), <i>"microbial coursework is huge...spent a good amount of time...I will need support please"</i> (Junior S)	Escalation to superiors for lack of time, comprehension difficulties
<i>L gave up on the process of compiling microbial coursework giving excuses, and entrusted N and P with the responsibility. They too habitually approached their superiors with task difficulties and sought clarifications.</i> (Manager and Senior)	Burning out in the middle of task assignments
<i>"has been vacillating on the background colour...spent days on it"</i> (Senior R), <i>"listed the pros and the cons but it's not black and white"</i> (Junior V), <i>"submission to DBT is overdue, because we need to make up our mind"</i> (Manager K), <i>"need to decide on the apportionment norms"</i> (Manager J)	Indecisive operational decision making at individual level
<i>"we will think about it tomorrow", three meetings ended with "we will finalize next week"</i> (Manager J, K, L)	Procrastination in decision making
<i>"we need to place the order for the autoclave...its overdue...audit is next week"</i> (Senior N), <i>"we are yet to submit confirmation for 1 week module delivery"</i> (Manager L), <i>"We still need to decide on the lead coordinator"</i> (Junior U)	Delay in conclusions and decision adoption
<i>"no one thinks in my department"</i> (Manager L), <i>"colleagues are dumb...cannot think"</i> (Manager K), <i>"team cannot think. How can I spoon feed new ideas"</i> (Manager J), <i>"Potential is high but we are not able to deliver. It is sickening no one has any ideas", "essential to innovate but how is the question", "I am unable to think", "forcing myself to think"</i> (Manager K)	Difficulties in idea generation and creativity to ease difficult situations
<i>"restricted thinking and minimal progress"</i> (Senior N), <i>"No time to think creatively"</i> (Senior M), <i>"...trying to find solutions but my thinking is stuck."</i> (Senior O), <i>"future needs breakthrough ideas"</i> (Senior Q)	Department initiatives for continual improvement
<i>No voluntary offers of help were observed when participants struggled with experiments, with participants in close proximity turning a blind eye to the episode, not bothering to rectify visible procedural errors</i> (Senior M, P, Junior S)	Willingness to help colleagues based on understanding the situation

<b>Representative primary data</b>	<b>1<sup>st</sup> Order Concepts</b>
<i>When M requested help amongst participant colleagues for a module on mass transfer, “have a deadline tomorrow but an important family commitment”, participants walked away saying, “no time on my side buddy”, “have a client meeting”, “ sorry mate...no time” (Seniors Q, P)</i>	Attending onto calls for help beyond individual responsibilities
<i>When P struggled to deliver thermodynamic calculations which became understandable with the hours he spent at a stretch on the desk, I overheard L saying, “Don’t worry hero...I will help you with the stats” and S saying “Leave the costing part to me” (Manager L, Junior S, Senior P)</i>	Exerting beyond responsibilities to help colleagues
<i>S and U raise concern on noise levels from the production team and enquire, “would the customer find it ok” (Junior S, U). L, W raise concern on administration issues by saying, “It is painful to see dripping water and dry plants in our facility” (Manager L, Junior W)</i>	Contribution to remedial measures in other departments of the organization
<i>when O and S voluntarily offered to take responsibility for designing the JC module. Their approach was beyond the motivation and sense of responsibility expected from their professional levels (Senior O, Junior S).</i>	Keeness to undertake additional responsibilities to complete tasks
<i>“just crack it buddy, you will come out with flying colors” (Senior M), “come on people lets ace it” (Manager L)</i>	Inspiration of each other to meet department goals
<i>When the team was working to make the rmz quotation at short notice, ‘U’ stated, “I have made a shortcut using macros and the if function... we can save a good amount of time by using it” (Junior U)</i>	Togetherness in efforts directed at achieving department tasks
<i>“Heard of your stellar customer ppt... Good job buddy” (Junior W), “wow...you were super quick man” (Senior N), “We were talking about you...Awesome performance” (Senior R)</i>	Attitudes and celebration of individual successes

Reference: Adapted from Gioia et.al., 2010

## **4.0 Study Findings**

The goal of this study was to determine the organizational impact of humanizing a workplace built environment through Eastern design practices and concepts in environmental psychology. The research questions are outlined in section 1.1.5. Findings on the research questions are organized around categories that developed during data analysis (see 4.1). Primary data used to support the findings have been justified and italicized for easy readability and a clearer understanding of the situation (Corden and Sainsbury, 2006). While presenting the study findings, key results under each category or main theme have been presented using “appropriate verbatim quotes” (Burnard et al., 2008).

Findings in this section have been divided into the impact of the study intervention on 1) Moods and Emotions 2) Productive workplace behaviors and 3) success factors of the participants.

As moods and emotions are part of a temporal process that encompasses several workplace settings and channel into general affect categories (Totterdell and Niven, 2014), findings have been illustrated through multiple examples of participant incidences and statements as evidence to justify affect categorizations (Corden and Sainsbury, 2006). Since productive workplace behaviors need a holistic overview of the situation (Appelbaum et al., 2007), the background incident profiles have also been explained at length for a rich ethnographic “confessional tale of the field” (Van Maanen, 2011).

### **4.1 Defining core constructs in the Findings**

Findings section is important for the reader to clearly understand the study (Barratt et al., 2011; Tuncel and Atan, 2013). Thematic analysis and data structure were facilitated through deciphering first order concepts, second order themes and aggregate dimensions (Corley and Gioia, 2004; see 3.3.5 and Appendix 7). To make it comprehensible, definitions should be provided of the core constructs and categories that constitute the findings (Gibbs, 2007). In this sub-section, I define the codes and categories that evolved from the primary data analysis.

### 4.1.1 Categories – Inclusion Principles (Table 3.21)

Category classification	Definition	Inclusion criteria
Emotion (Reaction)	Emotions are temporal reactions to specific external stimuli that express as a physiologic arousal (Pathak et al., 2011). They are intentional and are a response to surroundings, people or event. People can identify the cause of their emotions. Emotions are acute in nature and last for a short period of time (Ruiz, 2015; Ekman, 1994; Fish, 1985).	<ul style="list-style-type: none"> <li>• Causation to the displayed emotion is attributed through observation and confirmed during one to one discussion.</li> <li>• If the emotion can be attributed to a specific cause, then it is classified as an emotion.</li> </ul>
Mood (Innate)	Moods are longer lasting innate emotional states that do not need a stimulus for activation (Pathak et al., 2011; Ruiz, 2015). They are not intentional, have no identifiable cause and are not directed at any subject but at “the world as a whole” (Frijda, 2009; DeLancey, 2006)	<ul style="list-style-type: none"> <li>• Causation to the displayed emotion is attributed through observation and confirmed during one to one discussion.</li> <li>• If the displayed emotion cannot be attributed to a specific cause either through observation or through one to one discussion, wherein the participant cannot find a specific cause to explain the feeling, then it is classified as a mood.</li> </ul>
Emotion Detection	Understanding the prevailing participant emotional states (Fernandez-Caballero et al., 2016).	<ul style="list-style-type: none"> <li>• This includes understanding basic emotions of participants through observation of facial expressions, body language during team meetings, Co-working and one to one discussion.</li> <li>• Behaviors and Instances of Valence (pleasantness) are also observed to determine work participation – active or inactive, and pleasantness or unpleasantness in participant interactions during team meetings and co-working.</li> </ul>
Emotion Classification	Affect state arrived through emotion detection and determined on a two-dimensional model of activation and pleasantness. This broad construct does not dwell on identification of various specific emotions and moods but rather focuses on the core affect which is broader than emotion and mood (Ekkekakis, 2013) and relates to “the most elementary consciously accessible affective feelings that need not be directed at anything” (Russell & Barrett, 1999). This model serves as the most widely agreed conceptualization of affect (Davern et al., 2007).	Based on the pleasantness and activation model, affect at work is classified into: Activated Unpleasant Affect, Activated Pleasant Affect, Unactivated Unpleasant Affect, Unactivated Pleasant Affect (Warr et al., 2014).

<b>Category classification</b>	<b>Definition</b>	<b>Inclusion criteria</b>
High Activation Unpleasant Affect	This is an unhealthy emotional state, where participants displayed high activation levels and an unpleasant disposition.	Participants were nervous, anxious, tensed and worried (Li et al., 2017).
Low Activation Unpleasant Affect	This is an unhealthy emotional state, where participants displayed low activation levels with an unpleasant disposition.	Participants were mostly depressed, hopeless, despondent and dejected.
Low Activation Pleasant Affect	This is a healthy emotional state, where participants displayed a pleasant disposition with low activation levels.	Participants were relaxed, calm, laid-back and at ease.
High Activation Pleasant Affect	This is a healthy emotional state, where participants displayed a pleasant disposition with high activation levels.	Participants were inspired, joyful, excited and had an enthusiastic outlook.
Productive Behavior Detection	Employee behavior that positively contributes to the objectives and goals of the organization (Jex and Britt, 2014; Ponte and Rizzi, 2010). This includes traits of self-motivation, self-supervision (Taomina, 2009), job performance and organizational citizenship (Jex and Britt, 2014).	Instances that demonstrate communication, Task execution, Decision making and pro-social behaviors.
Communication	Social and interpersonal interactions that are necessary in a work environment. These psychological perspectives of communication are expressions determined by attitudes, perception, emotion and cognition (Jensen, 2003; Krone et al., 1987). Positive affect is often expressed through better interpersonal communications and improved collaboration across individuals (Choudhury and Counts, 2013). Collaborative interactions with other individuals are essential to complete a task or achieve a goal in a team (Schuman, 2006).	Formal and informal interpersonal communication amongst colleagues. Depending on the individuals and parties involved, it could be departmental, inter-departmental or stake holder communication.
Task Execution	This deals with the non-cognitive, emotional and behavioural approach adopted to accomplish a task as part of a routine work role (Heckman, 2012). Across tasks, successful execution and outcome involves a repeated loop that includes planning, execution and evaluation (Adamczyk and Bailey, 2004).	Task execution traits that include: <ul style="list-style-type: none"> <li>• Self-rated goal attainment</li> <li>• Participation and commitment</li> <li>• Self-efficacy and persistence</li> <li>• Performance factors</li> <li>• Personal factors that influence task execution</li> </ul>
Decision Making	It is the ability to make an informed choice from different available alternatives to reach an objective (Duque et al., 2013).	This involved understanding: <ul style="list-style-type: none"> <li>• Generation of alternatives.</li> <li>• Clarity of decisions</li> <li>• Time taken to make decisions.</li> <li>• Quality of problem solving</li> </ul>

Category classification	Definition	Inclusion criteria
Pro-social workplace behaviors	They are broad based helping behaviours that are performed to benefit and help a team member or colleague at the workplace (Krebs, 1982). They represent behaviours that strive to exceed expected requirements of performance, staying with the organization, going beyond role requirements, cooperating with colleagues, resolving conflict situations, taking proactive actions to protect the interests of the organization and speaking positively about the organization with a strong sense of team identity (Brief and Motowidlo, 1986). Positive affect has been shown to increase pro-social behaviors (e.g., Rosenhan, Salovey and Hargis, 1981; Isen and Levin, 1972).	By Observing: <ul style="list-style-type: none"> <li>• Backing up and helping behaviors amongst participants</li> <li>• Undertaking extra role behaviours beyond the participant's scope of formal responsibility</li> <li>• Organization citizenship and team identity traits</li> <li>• Conflicts and their management</li> </ul>

#### 4.1.2 Definition of codes (Table 3.22)

Codes	Definition
Emotional reaction to triggers within the participant team context	Participants displayed emotions as a reaction to actions from their participant colleagues within the same working team in the training department. This was a response to training department colleagues with whom the participants work together on a daily basis and share responsibility and accountability for the functioning of the department.
Emotional reaction to triggers from outside the participant team	Reactions displayed by the participants in response to stimulus from individuals of a different department or from outside the organization. Individuals from a different department are colleagues from the perspective of the larger organization but do not share accountability and responsibility for the functioning of the training department. Individuals from outside the organization are external stakeholders such as vendors and customers.
Innate Mood without external Triggers	Emotions displayed by the participants that have no specific reason or causation after analysis by the researcher and the participant's self-analysis arrived at after the one to one discussion.
Departmental communication	Interactions and relations within members of the training department (Gizir and Simsek, 2005).
Intra-departmental communication	Interaction and relations with members of other departments in the organization.
Stakeholder communication	Interaction with individuals outside the organization such as vendors and customers.
Participation and	This refers to personal engagement and "the degrees to which people occupy job roles." (Kahn, 1990). When individuals

Codes	Definition
commitment	are fully engaged, they occupy themselves fully into the work role – physically, emotionally and intellectually. Scholars suggest that engagement increases with work commitment. Commitment is a willingness to exert effort, an appreciation of responsibility to accomplish a team goal and a sense of obligation to an entity or individuals such as co-workers, supervisors, employers and customers (Vance, 2006; Mowday, Porter and Steers, 2013).
Task Persistence	Task persistence can be defined as the degree to which a person can maintain duration of action on the chosen or allotted task execution (Seo et al., 2004). Studies have shown that individuals with higher self-efficacy demonstrate greater task persistence (Gist and Mitchell, 1992).
Self-efficacy	Self-efficacy is an individual’s personal belief in one’s own ability to engage in effective work and achieve goals (Vance, 2006; Bandura, 1982). Positive moods have been shown to increase self-efficacy and task persistence (Kavanagh and Bower, 1985; Tsai et al., 2007).
Self-rated goal attainment	Goal attainment is a sense of accomplishment in a work related undertaking. As goal attainment is positively associated with measures of well-being and positive affect (Boudreaux and Ozer, 2013), self-rated wellbeing measures in the study are used as an indicator of goal attainment. This is verified upon subsequent one to one discussion with the participant.
Decision making time	The length of time taken for effective information processing to make a decision. Effectiveness of decision-making can be assessed through the time taken to make a decision. Individuals with positive affect show less confusion while making decisions (Duque et al., 2013).
Alternative Generation and problem solving	Problem solving and alternative generation is the ability to see relatedness between different prospects and opportunities in new ways to find a solution to a problem (Isen et al., 1987). Positive affect increases creativity in problem solving and increases alternatives generated (Choudhury and Counts, 2013; Amabile et al., 2000; Isen et al., 1987).
Backing up behaviors	Helping other team members with task related efforts and relevant resources when it becomes evident that the said team member is failing to achieve task accomplishment. This can be voluntary in nature when the backup provider becomes cognizant of the situation or in response to specific requests for assistance (Porter et al., 2003). Backing up behaviors is essential for effective team performance (Porter et al., 2003).
Extra-role behaviors	Helping co-workers with non-task related problems that is not expected from the said extra role provider’s scope of responsibility or directly recognized by the organization’s formal reward system (Organ, 1988). In such cases the extra role provider is not obligated to help an individual with a job related problem (George, 1991). Extra role behaviors are essential for the effective functioning of an organization (Katz, 1964).
Team Identity	This is the degree to which a sense of team belongingness is incorporated into the individual self-concept (Gundlach et al., 2006). Team identity is the extent to which team individuals identify themselves with their respective teams (Ellemers et al., 2013) and develops positive feelings about the team. Individuals with high levels of team identity engage in helpful behaviors and share knowledge (Ellemers et al., 2013). Studies have shown strong association between positive emotional state and work team identity (Johnson et al., 2012; Reis and Puente–Palacios, 2018). Team identity has been shown to play a significant role in promoting pro-social and helping behaviors in teams (Bruner et al., 2014).

Codes	Definition
Conflict Management	Boulding (1957) defined conflict as “A situation of competition in which the parties are aware of the incompatibility with the wishes of the other” (In Capozzoli, 1995). Conflict management is resolving a situation amicably through negotiation, cooperation, collaboration and compromise. Managing a conflict is a prosocial behavior (Brief and Motowidlo, 1986). Individuals with positive affect avoided confrontation, contentious tactics and attained favorable negotiated outcomes involving different issues (Baron, 1990). Positive individuals also avoided discord creating situations and countered negative reactions from colleagues through settlements and compromise. Positive affect in individuals also increased “preferences for cooperative conflict resolution strategies” (Baron, 1990).
Nervous	An individual trait of getting alarmed and easily agitated.
Anxious	Feeling of unease about an uncertain result (Totterdell and Niven, 2014)
Relaxed	A state when you are comfortable and nothing worries you (Li et al., 2017)
Calm	Without noise or hurried movement and quiet (Li et al., 2017)
At Ease	To become less difficult and more approachable (Li et al., 2017)
Laid Back	Not worried or excessively bothered about things that have to be completed or other people’s behavior (Li et al., 2017)
Hopeless	Without skill and depressed about the future (Li et al., 2017)
Dejected	Disappointed and feeling low after a loss or missed target (Li et al., 2017)
Grouchy	Complaining about lack of control on individuals and circumstances (Cropanzano et al., 2003)
Tired	Exhausted and feeling drained out (Fernandez-Caballero et al., 2016).
Drowsy	To be in a state between being awake and sleepy (Fernandez-Caballero et al., 2016).
Sluggish	Operating with less energy and slowly than usual (Fernandez-Caballero et al., 2016).
Bored	Not interested in the subject matter (Fernandez-Caballero et al., 2016).
Dull	Not sharp or intelligent and delay in applying the mind (Fernandez-Caballero et al., 2016).
Excited	Showing intense and eager interest in doing something (Li et al., 2017)
Joyful	Feeling or expressing extreme happiness and pleasure (Li et al., 2017)
Inspired	Motivated to achieve an objective (Li et al., 2017)
Enthusiastic	Intense enjoyment while executing a work related assignment (Li et al., 2017)
Annoyed	Mental state that is irritated and slightly angry (Fernandez-Caballero et al., 2016).
Upset	Feeling let down, disappointed and unhappy about an outcome or result (Cropanzano et al., 2003)
Anger	“A demeaning sense of offense against me and mine” (Totterdell and Niven, 2014). It is always concerned about the action of another person (Gibson and Callister, 2010) and is a form of a core affect that is activated and unpleasant (Fernandez-Caballero et al., 2016).
Disgust	An intense feeling of revulsion to an individual or subject (An, 2017). This is a form of a core affect that is activated and unpleasant (Fernandez-Caballero et al., 2016).

Codes	Definition
Fearful	Frightened about an incident or pressing requirement (Fernandez-Caballero et al., 2016).
Jittery	Unsteady and under pressure because of several factors and not anyone in particular (Crawford and Henry, 2004; Fernandez-Caballero et al., 2016).
Distressed	Feeling sorry and a situation in urgent need of help (Fernandez-Caballero et al., 2016).
Interested	Giving more attention to a subject and attempting to discover more about it (Crawford and Henry, 2004)
Elated	Extremely delighted and happy because something has been achieved (Fernandez-Caballero et al., 2016).
Lively	A manner that is full of life, outgoing and active (Fernandez-Caballero et al., 2016).
Thoughtful	Absorbed into deep thought and contemplation of options.
Composed	Having expression and feelings under control
Proud	Satisfaction with one's own achievement and high opinion of oneself (Crawford and Henry, 2004)
Attentive	Listening carefully to statements and dialogues (Crawford and Henry, 2004)
Alert	Quick to notice new concepts, surrounding circumstances and their possible application (Crawford and Henry, 2004)
Determined	Whole heartedly pursuing goals and not allowing difficulties or anyone to stop you in the pursuit (Crawford and Henry, 2004)
Preparation time	Preparation time is defined as the time taken between presentation of a work target and initiation of the task execution (Kohen et al., 2017).
Workload coping ability	Workload is defined as the degree to which urgency and pressure dominate in the workplace environment (Lacey et al., 2007). Coping ability is the personal cognitive and behavioral efforts implemented to manage the pressure at the workplace (Dix, 2017).
Creativity	Creativity is a trait that facilitates participants to solve problems and difficulties with an inventive solution (Drapeau, 2010; Isen et al., 1987). Creativity is defined as the process of identifying deficiencies, problems, disharmonies and searching for solutions to generate novel and useful ideas. Authors such as Amabile and Pratt (2016) have differentiated between creativity and innovation as idea generation and implementation of creative ideas respectively. Others have defined creativity as the production of novel and useful products (Mumford, 2003) or generating "something original and worthwhile" (Sternberg and Sternberg, 2016). For the purpose of this thesis, I subscribe to the view that creativity devises new and novel ways for effective work execution.
Voluntary knowledge sharing	Voluntary knowledge sharing is the dissemination of expertise in the workplace through informal structures, interpersonal ties and pro-social behaviors (Kumar et al., 2007). Some employees in an organization possess better knowledge than others (Cai and Xu, 2008). Voluntary knowledge sharing typically happens with strong interpersonal relationship (Sambamurthy and Subramani, 2005) and is an important means to maintain close relationships at work (Cross and Sproull, 2004).

## **4.2 Snapshot of Intervention study findings (Study 1)**

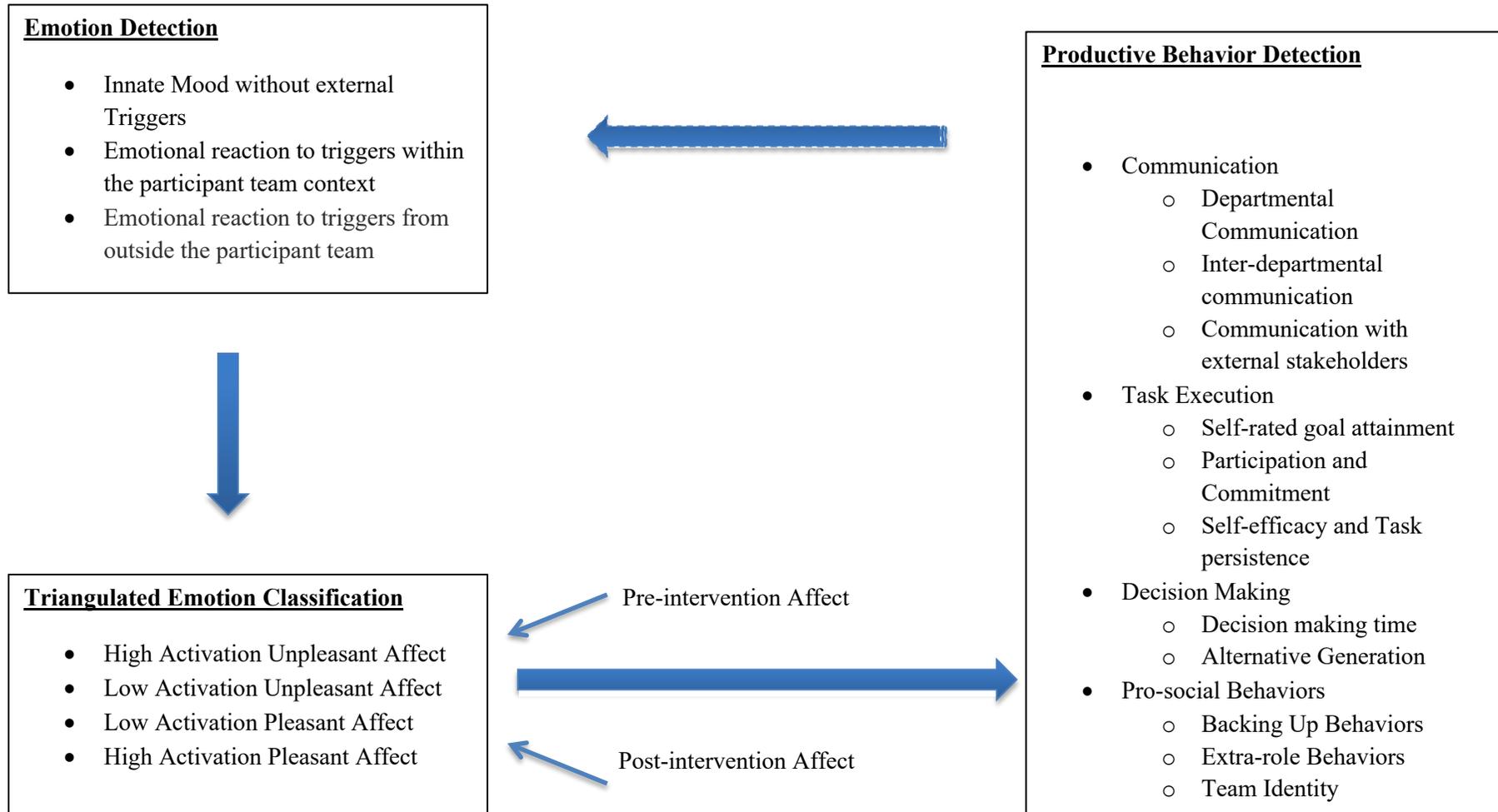
To facilitate cumulative and structured understanding of the empirical findings, this section organizes the findings into a diagram that will allow the reader to establish connections between field data and theory (Gnyawali and Song, 2016). In addition, diagrammatic representations can also be used to condense and clarify information for the reader through linking of different data categories (Bingham and Eisenhardt, 2011).

During the course of this study, I observed the positive effects of the intervention on participant affect profile (see 4.3). As indicated in literature, positive moods and emotion could have influenced the formation of productive behaviors (Nelson and Cooper, 2007) that were observed in my post intervention data collection (see 4.4). I also found that the resulting successful task outcomes further reinforced the positive affect profile and superior wellbeing self-ratings noted in the study participants (Flink et al., 2018).

Conversely, the pre-intervention findings had presented a negative affect profile amongst the participants, with dissatisfaction in achieving task completion. I also observed unpleasant participant behavior that hindered efficient task execution and peer bonding at the workplace, which was further reason to aggravate the low self-ratings.

Themes that emerged from the pre intervention and post intervention field study, and aggregate effect of the intervention as observed on the study participants is shown below (see figure 4.1). The following sections describe these findings and trace the journey into a positive affective and behavioral workplace environment.

**Figure 4.1: Snapshot of Intervention Study Findings**



## 4.3 Moods and Emotions

This section discusses the prevailing pre-intervention affect landscape of the participants and chronicles the changes post intervention. As team members bring in their individual affective characteristics to their teams, which then combine into a team affect (Kelly and Barsade, 2001); study findings on emotional landscape is the triangulated convergence of participant emotions observed while co-working, during meetings, participant account of the recorded observation in my daily log, my reflections on the observation and the participant self-rating on their state of wellbeing.

### 4.3.1 Pre-intervention Affect Landscape

Participants will be able to judge moods when the importance of judging mood is made salient (Kelly and Barsade, 2001; Barsade, 2000; Totterdell et al., 1998; Bartel & Saavedra, 2000). As such, during one to one discussion with participants, the need to understand participant mood and emotions were made salient with pertinent questions (e.g., *“How do you feel?”*, *“How is your mood?”*, *“What emotion do you feel with all this?”*, *“Generally do you feel this way?”*, *“ok got you...so what’s your happiness index?”*). As emphasized in literature, I found that it was often complex to decipher the emotional landscape (Ekkekakis, 2012), with several participants finding it difficult to answer questions on feelings and levels of happiness (e.g., *“I don’t know, “it’s all mixed”*), which required prompting on situations from my daily log (e.g., *“Saw the contamination in the lab and people were upset?”*) and reflecting loud on the participant’s self-rating (e.g., *“So you were not happy. How come?”*; *“Is it because of hazop incident, may be...?”*). I noted that reactionary instances where a reason could be attributed for the feeling state; typically occurred on the days of team meetings or when job related interactions were not pleasant or constructive. In several such instances, participants narrated experiences as an aftermath to work experiences and interactions during the day (e.g., *“feel it’s best to stay quiet than to get into arguments”; “no sensible thoughts from them”; “Too many deadlines and unnecessary pressure”*).

On the other hand, during situations when participants could not attribute a reason for their self-ratings upon further enquiry (e.g., *“you are ok. Good...but a 3...perhaps something else that is bothering you at work?”*) and when no observations were recorded, participants displayed a long term coexisting emotional state (e.g., *“Don’t know...just feel low”*). This element of causation for

an emotional episode within my daily notes and participant account, allowed for the thematic categorization between an innate individual mood and a reactionary emotion.

With these circumstantial and background aspects fed into my analysis, I found that the prevailing affect within the department was generally unpleasant. Amongst the four options presented in the self-ratings scale, the vast majority of participants opted for a '3' or '4'. Thematic analysis yielded further categorizations based on levels of seniority (i.e. Manager, Senior and Junior), emotional intensities (i.e. High Activation Unpleasant Affect, Low Activation Unpleasant Affect, Low Activation Pleasant Affect and High Activation Pleasant Affect), generalized affect states and reaction intensity to perceived triggers (see 4.1.1).

#### **4.3.1.1 Prevailing Mood state**

This unit describes the pre-intervention mood state in the study participants. The study participants presented different mood state intensities and were categorized into Managers, seniors and juniors.

##### **4.3.1.1.1 Managers**

Managers displayed a pre intervention mood state that was High Activated and Unpleasant. Even without any attributable causations for a particular mood state, participants often gave a self-rated wellbeing of '4'. A general sense of frustration was also evident. I observed that managers were frequently irritable and impatient while delegating tasks (e.g., *"Do whatever don't ask me"*) and while supervising colleagues (e.g., *"I told you last time. Do the same thing"*), and not willing to listen while participant colleagues had a different perspective (e.g., *"but I don't think sequences will apply to this context"*). This mood state was subsequently confirmed when participants reflected on their **annoyed** temperament with statements during one to one discussion (e.g., *"I can sense becoming more irritable every year"; "It has become increasingly tough to be steady... edgy every now and then"; "I jump fast...that's me these days"*) and displayed generalized **nervousness** (e.g., *"I feel anxious...not so good. Don't know why"; "I am feeling stressed most of the time"*).

##### **4.3.1.1.2 Seniors**

Seniors presented a pre-intervention mood state that was Low Activated and Unpleasant. Participants often gave a self-rating of '3' and upon prompting for their reflection on the mood state (e.g., *"The best person who can analyze this will be you...things were ok...no one really bothered"*

*you and you had no reason to feel not so good...but why did you feel this way...I think understanding this can be quite helpful for our wellbeing*”), voiced statements that indicated generalized traits of **dejection** and **unhappiness** (e.g., *"Have a general sense of unhappiness. I am not able to express in words but many a times a feeling of emptiness"; "When I think, I am often sad for no reason"*), a **grouchy** disposition (e.g., *"I will say I am fine but thinking deep I feel my life can be better. Not monetarily I am happy. But overall a sense that things can be better"; "Too much disturbance...Loose focus midway of an assignment"*), and a self-perceived inability to feel contented due to **sluggishness** (e.g., *"Feel lazy...mind is frozen most of the time. It does not think"*), **Dullness** (e.g., *"I take a lot of time to grasp concepts here"*), **Drowsiness** (e.g., *"Actually I feel sleepy most of the time even while doing interesting assignments"*) and **tiredness** (e.g., *"A general feeling of debility...so my concentration seems to have gone for a six"*).

#### **4.3.1.1.3 Juniors**

Juniors exhibited a pre intervention mood state that was largely Low Activated and Pleasant. Despite an overall pleasant demeanor (e.g., *"I will work extra hours next week.no problem", "Sure will get it done"*), these participants often used a self-rating of ‘3’ to define their feeling state. This could possibly be attributed to their generalized lack of satisfaction in not achieving a tangible work outcome. They expressed statements that revealed a **laid back** nature (e.g., *"I was running around and chirpy but now not so much", "have become less active"*), a **relaxed** approach to work (e.g., *"I love my job but I feel I am wasting most of my time" and "work is easy"*) and an unsatisfactory sense of **at ease** (e.g., *"by the end of the day, I wouldn't have done anything much"; "schedules are adequate"*).

### **4.3.1.2 Prevailing Emotional State**

This unit describes the pre-intervention emotional state to unsatisfactory situations in the workplace. Through the thematic analysis, emotional state was further divided into those caused by situations within the team and those by circumstances outside the training team.

#### **4.3.1.2.1 Emotional reaction to situations within the team**

This section explains the emotional reaction of study participants to perceived triggers that originate from within the training department while doing daily work. As study participants presented different emotional intensities, descriptions have been given for emotional reactions of Managers, Seniors and Juniors.

#### 4.3.1.2.1.1 Managers

Managers had a High Activated Unpleasant Affect while addressing task responsibilities of supervision (e.g., module reviews, schedules), delegation (e.g., responsibility matrix and task allocation) and team discussions (e.g., team meetings). Their disappointed statements in response to unfavorable situations shed insights into an underlying affect of **anger** (e.g., *"my blood is boiling with the way people shoot down proposals"; "How dare do they give excuses for project executions"; "exploding from inside"*), **Disgust** (e.g., *"excuse mongers!" "When I allocate work, I know the time - guys exaggerating"; "irritates when I hear the babbling"*) and being **Annoyed** (e.g., *"team should be more eager", "useless meeting today", "colleagues should focus on analysis and not think of problems", "agitated overall...did not feel like being polite with anyone"*)

#### 4.3.1.2.1.2 Seniors

Seniors displayed a High Activated Unpleasant Affect while undertaking job responsibilities. As a reaction to pressing timelines (e.g., audit deadlines), work quantum (e.g., module delivery in five days) and group discussions to find solutions (e.g., ways to tide over water shortage), participants were **Nervous** (e.g., *"We have so many things to worry about...did not see the point", "cannot balance multiple assignments these days"*), **Fearful** (e.g., *"panic attack for me...there is no time", "opinions are taken personally"*), **Jittery** (e.g., *"Too many deadlines. Unnecessary pressure"*), **Distressed** (e.g., *"Trying new avenues tough...no one is on the same page"*) and **Annoyed** (e.g., *"how do we do everything", "How can people blame", "nothing moved after spending so much time"*).

#### 4.3.1.2.1.3 Juniors

Juniors presented a Low Activated Unpleasant Affect in response to unfavorable situations and criticisms from colleagues (e.g., *"Your work does not make sense", "Could you get the AMP by tomorrow"*) with statements that indicated **dejection** (e.g., *"was feeling low...with the delivery expectation"*), **hopelessness** (e.g., *"do not feel inspired"*), **sluggishness** (e.g., *"had a headache", "everyone was slow"*), **Dullness** (e.g., *"no one tells us how to complete faster"*), **tiredness** (e.g., *"work was tiring today", "eyes were aching"*), **Grouchiness** (e.g., *"wasn't told what to do", "goalpost is constantly moved"*), and **boredom** (e.g., *"sentiment is such that I don't feel like trying new things", "work was boring...was slow"*).

#### 4.3.1.2.2 Emotional reaction to situations from outside the team

This section explains the emotional reaction of study participants to perceived triggers that originate from outside the training department during interdepartmental meetings.

Managers and seniors together had a Low Activated Unpleasant Affect during interdepartmental meetings. They were self-introspective and displayed lack of confidence during discussions in teams with members from outside the training department. They became sensitized, became more self-aware of the shortcomings in the department and were unsettled with ideas and suggestions from other individuals in such meetings. Participant statements during one to one discussions while describing the meetings exhibited a sense of self-pity and **hopelessness** (e.g., "*manufacturing has so many options and I feel like a...dumbo*", "*others have to spoon feed us now*", "*was ashamed*", "*pained nothing is working*", "*we had nothing to contribute*"), **Dejection** (e.g., "*Appalling, others look at us after narrating their ideas*", "*Depressing others are coming up with new proposals not us*", "*others can deliver, we thought we were the best. That unnerves me*"), thoughts of an intelligence deficit and **Dullness** (e.g., "*I am unable to think*", "*creative juices...I don't know*", "*mind is cluttered to analyze*", "*thoughts are stuck*"), and a complaining **grouchy** outlook to suggestions from others (e.g., "*they are just making fanciful ppts*", "*Others have good colleagues to support*", "*everyone tries to gain brownie points*", "*lame...nothing relevant and they talk about the training building*").

### 4.3.2 Post Intervention Affect

Post intervention environment demonstrated a pleasant affect profile across participants. After about a month post intervention, participant self-ratings on innate mood states changed to a '2' or '1' and remained steady throughout the remaining period of the study. I also found that understanding the situation, deciphering the innate mood and emotional states, and participant reflections had greater clarity during one to one discussion. This was in line with suggestions from literature that a positive emotional state and upbeat mood of the interviewee will yield rich field data (Ogden and Cornwell, 2010). A shift in the affect environment was also noted in the individual demeanor during meetings, individual mood states and intensity of emotional reactions to unfavorable situations.

### 4.3.2.1 Mood State

This unit describes the post-intervention mood state in the study participants. The study participants presented varying degrees of pleasant mood states across Managers, seniors and juniors as shown below.

#### 4.3.2.1.1 Managers

Prevailing Mood state of High Activation, Unpleasant Affect in managers shifted to a Low Activation Pleasant Affect in the post intervention study period. This shift was noted in about 3 weeks post intervention. Further to the intervention, there was an almost immediate change in the self-ratings from '4' to '3', indicating a reduction in the activation intensity that became apparent in participant statements (e.g., "*Feeling ok. Bit more discussions*", "*Not Bad. Work to do. Worried about calibrations expiring*"). Two weeks post the initial change, the self-ratings then further stabilized to '2' or '1' and remained more or less constant during the remaining period of the field study. Co-working experience and meetings during the period were driven by a satisfied **calm** disposition (e.g., "*its ok. we will see...lets dissect the problem and address it one step at a time*", "*its ok to make mistakes*"), and participant statements that implied attributes of **calmness** (e.g., "*Good to hear multiple views*", "*good proposals from the team*", "*interesting but conflicting thoughts*"), **At Ease** (e.g., "*everyone were keen and cooperated*", "*they were complementing each other*", "*team is working well*"), and **Relaxation** (e.g., "*Happy with the cheerful atmosphere*", "*Feeling good*", "*things are fine*").

#### 4.3.2.1.2 Seniors

The affect state changed from Low Activation Unpleasant Affect to a High Activation Pleasant Affect. The participants went through an initial change period where traits of Low Activation Pleasant Affect dominated for about a week, marked by an open, introspective and calm demeanor (e.g., "*I observed that seniors patiently listened to suggestions from enthusiastic junior colleagues and were more thoughtful than usual*"). Participants also stated pleasant upbeat comments during this time (e.g., "*positive today*", "*some sensible thoughts*", "*clear action plans were outlined*").

This profile then subsequently improved to and then stabilized at a High Activation Pleasant Affect realm, marked by self-ratings of '1' or '2' and participant statements that indicated being **Interested** (e.g., "*with you... go on*", "*Did you consider what the others would think on this*"), **Inspired** (e.g., "*This can be done for sure...Let me give it a thought*", "*I will talk to a couple of*"),

connects...let's see what they have to say...but surely this can be worked around”) and **Joyful** (e.g., “We should have a party”, “good...No complaints”, “hmm...let me think...lovely weather”).

#### **4.3.2.1.3 Juniors**

Their affect shifted from Low Activation Pleasant Affect to High Activation Pleasant Affect. The change to a high-energy dimension was immediate and became apparent during team meetings with participant inspired self-initiatives (e.g., during the execution review, participants were forthcoming, apologized for the delay in submitting the report and proactively stated “it will reach your inbox before 6 pm”. Similarly, while discussing quarterly revenues and amidst the team silence, juniors mustered confidence and whispered, “We have some ideas and will work on a plan next week”. In the subsequent week, they presented market segments to align the portfolios. This was done at their own initiative).

Participant statements indicated an affect environment that was **Excited** (e.g., “tried a new combination approach for media feed...waiting to see the cells grow”), **Enthusiastic** (e.g., “diaphragm combinations is one probable option to address the leakage...don't know...I will try this asap”), **Lively** (e.g., “using my painting skills and drawing a collage outside the entrance for anniversary”) and **Elated** (e.g., “feeling awesome...think will go for dinner to a nice place).

### **4.3.2.2 Emotional state**

This unit describes the post-intervention emotional state to unsatisfactory situations in the workplace.

#### **4.3.2.2.1 Emotional reaction to situations within the team**

Emotional reactions noted in the post intervention period were largely positive. Negative reactions to emotional triggers that occurred lasted momentarily, thus avoiding a negative mood state. Participants displayed varying degrees of emotions and they are explained below.

##### **4.3.2.2.1.1 Managers**

A low Activation Pleasant Affect demeanor dominated in managers, while they delegated work responsibilities and during departmental meetings. They were **calm** and absorbed while giving instructions (e.g., “Please get the utility calls completed. It is important”). At times when there was failure to achieve the instructed objectives, they would momentarily become upset (High Activation Unpleasant Affect) (e.g., “I told you to give it priority, didn't I”, “I don't want to hear”) and briefly lapse into a realm of low activation (i.e. be quiet and thoughtful), and then quickly

revert to a Low Activation Pleasant Phase (i.e., composed and calm) (e.g., *“What are the other options to remedy this”, “What’s your plan B or let’s get to the bottom right away”*). They typically maintained the low activation pleasant phase during collaborative interactions and moved into high activation pleasant phase when inspiring colleagues (e.g., *“remember, if you could deal with RIL, this is a cakewalk actually”*). Participant statements while reflecting on the incidences revealed an introspective and considerate outlook that was **laid back** (e.g., *“Managing multiple deadlines would have been hard...will get better with time”, “They will catch up in the next phase”*), **Relaxed** (e.g., *“Was her first customer miss...its ok...that’s how she will learn”, “we learnt the process through this experience”*) and **calm** (e.g., *“ There was a delay in submission... I should reduce the load factor next time”, “Better planning along with the team is the key”*).

#### 4.3.2.2.1.2 Seniors and Juniors

Seniors and juniors displayed momentary Low Activation Pleasant Affect as a reaction to task criticisms and failed targets, before bouncing into the high activation pleasant affect phase. Participant statements alluded to a **calm** thoughtful demeanor (e.g., *“silence...I see your point. I should have put in greater resources. That’s where I went wrong”, “This was my oversight...It will not happen again”*), with **relaxed** (e.g., *“What has happened has happened. Going forward I will have clarity of actions”*), **Laid back** (e.g., *“SBIRI submission delayed big time...need a break and rethink fresh”, “Will ace it next time...have to devote more time. Simple”*) and **at ease** temperament (e.g., *“I am happy but not complete complete because of the delay...Hence a 2...Have to streamline my desk and looking forward to the holidays”*). Participants sometimes while countering critiques attempted persuasion at opportune moments (e.g., when supervisors mellowed down) and articulated thoughts with clarity and **composure** (e.g., *“there is the other title that is half completed...should we prioritize that”, “maybe we can confirm our understanding...I remember the customer preference for hydraulics”*).

#### 4.3.2.2.2 Emotional reaction to situations from outside the team

During inter-departmental meetings, Low activation unpleasant affect environment in the pre-intervention period shifted to a High Activation Pleasant Affect environment in the post intervention period. I observed that training members were articulate and firm in their discussion with other departmental colleagues. They were more confident, participated in inter departmental meetings and engaged actively with in-group discussions that were both within and outside the direct activity scope of the training department.

Participant statements while describing the meetings during one to one discussion, presented an appreciation of being **inspired** (e.g., “Loved the presentation of the production team. Want to make mine even better”), **Excited** (e.g., “ my hair stood up when I shared the Norwegian collaboration with the organization team...we did do good”), **Enthusiastic** (e.g., “ SK is tough but not impossible...just work harder right”), **Joyful** (e.g., “arguments were logical...loved it...felt happy to be a part”), **Proud** (e.g., “ we could deliver four submissions in a week...pretty sure no one can match that”), **Attentive** (e.g., “...actually was just joking when I pointed out the calculation mismatch”), **Determined** (e.g., “We too are going to do everything to beat the market...we want to be the best”), **Interested** (e.g., “market adoption news from production was enlightening...will take a look at the backward integration models to make it successful”) and **Alert** (e.g., “When I heard on the trade restrictions, it might not affect us...but have to verify”).

### 4.3.3 Summary of Mood and Emotion Findings in Intervention study

I observed a positive change in the affect profile of participants after the intervention. Pre-intervention mood and emotional states in participants were largely unpleasant to varying degrees. These states became pleasant post intervention and manifested into different intensities presumably based on positional hierarchies and scope of individual responsibilities.

**Managers** had a chronic high-activated unpleasant mood profile that was defined by being annoyed and nervous for no apparent reason. This became the de facto defining mood profile irrespective of the situation. Similarly, during unfavorable situations within the department, the emotional profile was outlined by reactions through expressions of anger, emotional outbursts and disgust. Post intervention modification in the built environment exerted benefits through shifting the innate manager mood profile to a Low activated Pleasant state defined by dispositions of being at ease, calm and relaxed. Upon unfavorable triggers from within the department, the manager emotional profile momentarily changed to a lower intensity High Activation Unpleasant Affect profile of being upset (Cropanzano et al., 2003) before stabilizing into a thoughtful low activated pleasant affect profile of being calm, relaxed and laid back.

Despite the absence of any ostensible reasons, **Seniors** had a prevailing low activated unpleasant mood profile defined by sluggish, dull, drowsy, and Grouchy characteristics.

Correspondingly, during unfavorable situations in the department, their emotional profile became high activated and unpleasant as depicted by observation of fearful, nervous, jittery and annoyed states. Post-intervention, seniors presented a mood profile that was High activated and pleasant as underscored by being proactive, interested, inspired and joyful during interactions. Upon unfavorable triggers from within the department, the emotional profile of seniors changed to a low activation pleasant phase with an emphasis on Calm, relaxed, Laid Back, at Ease and composed demeanor.

**Juniors** had a prevailing low activated pleasant mood state of being relaxed and at ease during the pre-intervention study period. This shifted to a high-activated pleasant mood state marked by excitement, enthusiasm, lively and proactive nature during the post-intervention study period. Similarly, while dealing with unfavorable situations in the department, their emotional profile changed from low activated unpleasant state (i.e., dejected, hopeless, tired and grouchy) in the pre-intervention study period to activated pleasant profile in the post intervention period (i.e., thoughtful, calm, relaxed and at ease)

Relatedly, during interactions outside the training department, the emotional profile of managers, seniors and juniors shifted from a low activation unpleasant profile of dejection and hopelessness, to one of High Activation Pleasant profile marked by a confident, inspired and enthusiastic outlook. I have summarized the affect findings with pertinent data codes in the tabulation below (Table 4.1).

**Table 4.1 Summary of the mood and emotion findings in Intervention study**

<b>Affect States</b>	<b>Participants</b>	<b>Pre-Intervention Affect</b>	<b>Codes</b>	<b>Post Intervention Affect</b>	<b>Codes</b>
<b>Mood</b>	Managers	High Activation Unpleasant	Annoyed, Nervous	Low Activation Pleasant	Calm, At Ease, Relaxed
	Seniors	Low Activation Unpleasant	Dejection, Grouchy, Sluggish, Dullness, Drowsy, Tiredness	High Activation Pleasant	Interested, Inspired, Joyful
	Juniors	Low Activation Pleasant	Laid back, Relaxed, At Ease	High Activation Pleasant	Excited, Enthusiastic, Elated, Lively
<b>Emotions within the Department</b>	Managers	High Activation Unpleasant	Anger, Disgust, Annoyed	Momentary High Activation Unpleasant to	Upset
				Sustained Low Activation Pleasant	Laid back, relaxed, calm
	Seniors	High Activation Unpleasant	Nervous, Fearful, Jittery, Distressed, Annoyed	Low Activation Pleasant	Calm, relaxed, Laid Back, At Ease, Composed
	Juniors	Low Activation Unpleasant	Dejection, Hopelessness, Sluggishness, Dullness, Tiredness, Grouchy, Boredom		
<b>Emotions outside the Department</b>	Managers	Low Activation Unpleasant	Hopelessness, Dejection, Dullness, Grouchy	High Activation Pleasant	Inspired, Excited, Enthusiastic, Joyful, Proud, Attentive, Determined, Interested, Alert
	Seniors				
	Juniors				

## **4.4 Changes to productive behaviors that followed the Intervention**

### **4.4.1 Communication**

Findings in this section advanced from the thematic understanding gained through the data category “communication”. Based on the coding analysis of observations and other collected primary data, communication could be classified into interaction within the department, inter-departmental interactions and interactions with external stakeholders. Each of these aspects of communication have been elaborated in subsequent paragraphs.

#### **4.4.1.1 Internal communication within the department**

Findings in this sub-section relate to the tone and degree of formal and informal communication amongst study participants at the workplace (see 4.1.2 for the definition)

##### **4.4.1.1.1 Pre-intervention phase**

Was devoid of any observable informal chats, discussion or Duchenne smiles amongst team members. There were no collaborative discussions or joint approach in resolving issues. Coordination within team members was scarce and often one-liners without eye contact (e.g., “Can you do this”, “I have completed it”). I also noticed that effective coordination and communication amongst team members that were required to fulfill day-to-day responsibilities was not happening. Data dissemination, awareness of joint task requirements and responsibility matrix information flow were compromised due to lack of effective informal communication and engagement. This lack of communication amongst team members decreased efficiency and increased the time for operations. I narrate below an incident that is typical of such communication issues affecting task completion in the training department: *Today, J expressed shock at seeing K and L presenting similar course modules. K in turn questions O and P and find out if the ongoing responsibility was communicated with M and N. O reasons that since the information was put up on the white board, it was taken for granted that M and N would have seen it as part of their respective responsibility and did not consider it necessary to discuss orally.*

Participant communication was also affected by perception of ignorance and assumption of a cold response from others. This prevented understanding and deliberating the issues confronting them. I became aware of this through participant discussion, when the participant mentioned: *I was not making any progress on the FEA analysis. I was aware the deadline was nearing...and definitely could not complete it... but no seniors were approachable that I could discuss and seek solutions.*

Another aspect that affected effective communication was the quality and completeness of peer interactions. Information exchange did not frequently contain pertinent or complete data. I assessed that participants were anxious of superior reactions and this prevented them from reporting up to date information. For instance, *When the media stock was exhausted, the participant resorted to an alternative means to complete the experiment. Non-reporting of the issue however resulted in its non-availability for other priority experiments that were outside this participant's direct responsibility. Upon enquiring, I was informed by the participant, "Did not want to be held accountable for not ordering the media stock. Anything that I say will result in belittling of my capabilities."*

I also observed that personal emotional states of participants affected interaction amongst team members. Heat of the moment, misplaced reactions did not inspire further helpful communication within the context. Lack of emotional maturity in interactions resulted in misunderstandings based on perceived negative intentions and resulted in a discouraging atmosphere. I narrate an incident in my research dairy that will help to understand the situation: *I overheard a heated argument in the office. N was agitated and started shouting at S – "If you want to give priority to her, do that. I don't want to see you again. I clearly told you, I want this assignment completed and you are telling me you had to do that". The conversation ended abruptly. Later upon enquiring on the situation, I realized that S had conducted with the best of intentions, as that piece of work was important for N's documentation.*

Moreover, individuals with a sensitive personality profile tended to restrict their involvement with an "answering to the point" approach. This affected the team bonding due to lack of additional involvement and their perceived non-commitment in task execution. As an example to grasp the situation, I quote a participant's comment, *"I hesitate to participate. Frankly my colleagues are moody and their reactions many times don't make sense."*

Additionally, irritability also created an unfriendly atmosphere that generated a trust deficit, which further impeded open communications. P quoted an instance of this during the one to one discussion, *"will sound silly, but I doubt everyone at work..."*

#### **4.4.1.1.2 Post intervention Landscape**

Post-intervention communication landscape had greater cordiality, informal chats and Duchenne smiles amongst the participants. I observed that team members started going to lunch together, were speaking more frequently and discussing work challenges openly. Coordination with team members was better, showed greater empathy and participants initiated conversations enquiring about personal circumstances while maintaining eye contact (e.g., *"How's your son...is he better now", "It's not the best weather...we have to be careful...my family is all*

*down with fever*”). Participants who delegated work responsibilities – described patiently at length, the purpose and background of the task (e.g., *“The documentation part is important for Sandy...accuracy and schedule is paramount...can you put your efforts into this”*).

Better communication within the group ensured that work profiles were streamlined and repetition of work was preempted with information exchange across participants (e.g., *When S overheard the task allocation for M; S stated, “I think O is also doing the same thing” and phones O to confirm. This informal discussion saw M and O collaborating and streamlining their activities*). Quality and completeness of peer interactions as well improved with better communication. Participants did not hesitate or assume a negative reaction while providing information or updating work status (e.g., *“It’s just three days more. Wanted to keep you updated to ensure if I am on the right track”, “culture strain is running out...I was the last one who could use it”*).

I noted emotional maturity and a calm demeanor while dealing with unexpected situations (e.g., *“When a junior prioritized BKC cell line against instructions, the senior attempted at understanding the situation by asking “Any reasons you did it this way” at which the junior commented “ I wasn’t confident and you were busy so asked somebody, but clearly was an error of judgment”. At this the senior explained “Don’t bother, interrupt me anytime...I feel BKC need not be prioritized if there is a -80 freezer, which we have”*). A positive emotional state that patiently comprehended situations and facilitated understandings, reinforced communication lines amongst participants and created an encouraging atmosphere. In addition, participants teamed up to encourage an inspiring atmosphere with motivating communication (e.g., *“Don’t worry. I am sure it will be fine”, “you have give it your best. That’s all that anyone can do. So chill”, “you will do better next time”*).

I also observed that conversations lasted longer and there was an active effort to engage with participants when feedbacks were solicited (e.g., *“you seem to have a different view... come on tell me”*). Besides, inherent trust promoting behaviors became apparent when participants shared their reservations and anxieties (e.g., *“I have a function at home next week, the very time when delivery for K2 gets due”*), and were positively responded to (e.g., *“ You look down...is everything fine with you”, “share your constraints freely”*).

#### **4.4.1.2 Inter-departmental Interactions**

Inter departmental communications pertaining to the study participants revolved around discussions on general strategy and an independent perspective on respective operations during meetings. There were also occasional discussions on sharing available support resources such as housekeeping staff for optimizing resources.

#### 4.4.1.2.1 Pre-intervention

Communication during inter departmental meetings was sparse if at all. Body language was often rigid and attendance appeared to be against free will. The default position from training team members was silence, disinterest and a lack of interest in meeting proceedings. With my insistence on their opinions, they would non-confidently and shyly mutter in line with larger team sentiments with bearish comments such as “*I agree with the rest*”. This approach was different from other meeting participants who engaged in active constructive debates and thought provoking conversations. I did not observe any Duchenne smiles or a welcoming disposition from the study participants during these meetings.

There was an inherent resistance amongst the study participants to adopt new processes that eventually got dissolved within larger group opinions. Besides, they were not forthcoming in presenting their viewpoints. To illustrate an example from my daily note: *Today during the HOD meeting, all the non-training team members deliberated and wanted to adopt 5S. Work quantum, time utilizations and routine disruptions were discussed. The overall sentiment was to bear the hassle and go ahead with its implementation. Upon insisting the silent training team members to give a feedback they commented “Ahhh.. (silence) Its ok”*

Training team members were also not open to constructive feedback. There was an air of nonchalance and they adopted a cold defensive posture on hearing new insights. This trait froze meaningful discussions with other team members. To illustrate this situation, I quote from my daily note: *While discussing campus cleanliness, a production colleague pointed to the vegetative overgrowth near the training building, there was no reaction for a few seconds. The study participants then softly said, “We have not seen”.* Similarly, *when they raised concern on excessive boiler usage, the study participants murmured non-confidently, “this is needed for our operations. So how reduce”.* When other Departmental HOD’s raise possible concerns on the safety policies practiced by the contractor’s workmen, *Training HODs were silent, made no comments, showed no awareness and did not seem to be bothered.* Upon enquiring about these instances during one to one meeting, there was a sense of frustration and irritability. To understand the sentiments, I quote their narrations from my daily log, *“it irritates that others get into our domain” “everyone tries to gain brownie points” “lame...nothing relevant and they talk about the training building”*

In addition, the negative outlook presented by the training team members, dissuaded further communication with members from other departments. To understand this situation, I quote an instance, *On exploring options for reallocating redundant cleaning staff from the training lab to the production centre, training members expressed concern on resource shortage in case of absenteeism.* Indifference and non-participation in finding solutions to common issues also curtailed open

communication. An instance for this was – *while discussing ways to tide over water constraints, training team members made no contribution and did not participate in discussion except nodding their heads.*

#### **4.4.1.2.2 Post intervention period**

Saw closer collaborative interactions during inter departmental meetings (e.g., *Training team requests leads from other department members by saying, “We need growth and growth and seek your support. Please scout for leads and let us know. Tell your colleagues as well please”*). I observed informal chats, friendly body postures and warm mannerisms before, during and after the meetings that were frequently interspersed with Duchenne smiles. Participation was active with engaged, thoughtful and sincere statements from participants (e.g., *“Considering the tectonic shift that we are seeing in perfusion, I feel you should focus on building the core competency of regulatory knowledge”*).

I also observed a confident outlook with strong opinions that were justified during the course of the meeting (e.g., *J puts up the need for more clean air compressors. The need is outlined well and queries from the other HODs were justified confidently versus the market potential*). Furthermore, several successful process executions from the training department also increased inter departmental communication (e.g., *“training department are on a turbo booster. You guys are churning something every week. Well done kudos, that’s the way the department has to be - a role model for the rest of us”*).

Besides, participants ignored individuality and were open to constructive feedbacks. They contemplated, constructively discussed and adopted differing viewpoints (e.g., *while discussing the 2025 strategy, production differed with training on the customer interface model. There was passionate deliberation on this and training team acknowledged and incorporated the production thoughts into the vision document*). Participants often expressed praise and gratitude to the other department members (e.g., *Its good you highlighted on the utility consumption...it was indeed a resource drainer*). To understand the participant feeling of gratitude, I quote their narrative from the daily log (e.g., *“very insightful, glad they paid attention to our domain”*).

Additionally, training participants actively involved themselves in matters outside their direct scope of responsibility. They provided insights into issues that confronted the production team (e.g., *“perhaps shifting the incinerator position can help”*) and were actively concerned on matters that affected the organization (e.g., *let me connect with some friends and understand the new PCB norms*). These forms of engaged and considerate conversations increased interdepartmental communication.

### **4.4.1.3 Communication with external stakeholders**

This section involves communication between study participants and external stakeholders such as customers and vendors (see 4.1.2).

#### **4.4.1.3.1 Pre-intervention**

I observed that training research participants were in haste while discussing with vendors. Body language did not look confident and firm. Collaborative projects where vendor expertise was essential struggled, as the training team members seemed inflexible and locked into an issue rather than solving it.

I also observed that interaction with customers lacked energy and enthusiasm. Research participants were not walking the extra mile to gain customer appreciation as was evidenced by the reticence in promptly addressing customer queries, *“When a customer requested a technical answer, the research participant suggested that the customer use the formal queries portal rather than directly addressing the query”*. There were also no efforts to build rapport with customers or engage in friendly informal conversations. This laid back approach had consequences for revenue maximization, when a customer informed me about market information that was missed as a result of lack of proximity with the customer.

#### **4.4.1.3.2 Post intervention**

I noted participants leveraging vendor competencies into client assignments through increased communication and a personal rapport (e.g., *Saw Burk executive at frequent intervals and the conference room occupied for more than 3 hours*). I also made an observation in my daily notes that *collaborative projects with vendor organizations have increased*.

Participants also managed customers more effectively and proactively. Customers frequently had words of praise for participants (e.g., *“Ashu did a fantastic job. I am sure he wouldn’t have slept with all the data crunching. You have got brilliant people”*, *“Nikhil did a good job”*). Participants connected personally with customers and became friendlier (e.g., *While talking to the GM of genx, M updated me, “Today is Sirs birthday”*) and in the process became more market aware and contributed to the sales meetings (e.g., *“Arvind of Panac was telling me that their gcc expansion plan has been approved and they will be hiring 300 people shortly... we can pitch in early”*).

## 4.4.2 Task Execution traits

Findings in this category advanced from the thematic understanding gained through the data category ‘Task execution’. Based on the coding analysis of observations and relevant primary data, task completion could be classified into participation and commitment, Task persistence and self-efficacy, self-rated goal attainment and performance measures. Each of these aspects has been elaborated in subsequent paragraphs.

### 4.4.2.1 Self-rated Goal Attainment

Self-rated task completion findings in this sub-section evolved from the thematic understanding gained through the data category ‘emotion/reaction’, insights in primary data revealed through the codifier ‘self-rated goal attainment’ and on assessment of the corresponding self-rated wellbeing scores. I observed during data collection a positive association between work related goal completion for the day and self-rated wellness measures. This pattern became apparent and was confirmed while discussing the self-rated goals during one to one discussion with study participants.

Relevant highly rated self-assessment (‘1’ or ‘2’) when rationalized under the data category ‘emotion/reaction’ often had task completion highlighted as a major reason for the high state of happiness recorded. It is plausible that the sense of achievement would have added to feelings of wellbeing in such cases. Yet at the same time, it is also pertinent to suggest that task attainment would not have been possible in the first place without favorable mood states. The pre-intervention scenario was marked by negative self-rated measures (‘3’ or ‘4’), across the study participants. Upon discussion during one to one meeting, study participants either attributed the self-rated feeling to task completion (reaction) or generalized feelings without a cause (innate). As this section discusses the findings under the ‘reaction’ data category, all recorded instances were to do with reaction to task completion either directly or indirectly. Therefore, it was appropriate to consider self-rated wellness measures under this category as measures of self-rated goal attainment.

During the pre-intervention phase, managers frequently had a rating of ‘4’, which was attributed to the non-completion of department tasks within the due deadline (e.g., “*review is taking time and we could not finalize the chrome configuration*”). Seniors and juniors typically had a rating of ‘3’ when they completed their specific role in the task assignment (e.g., “*I am ok, I finished my part of the work*”). Self-rating however became ‘4’ when a non-completed assignment

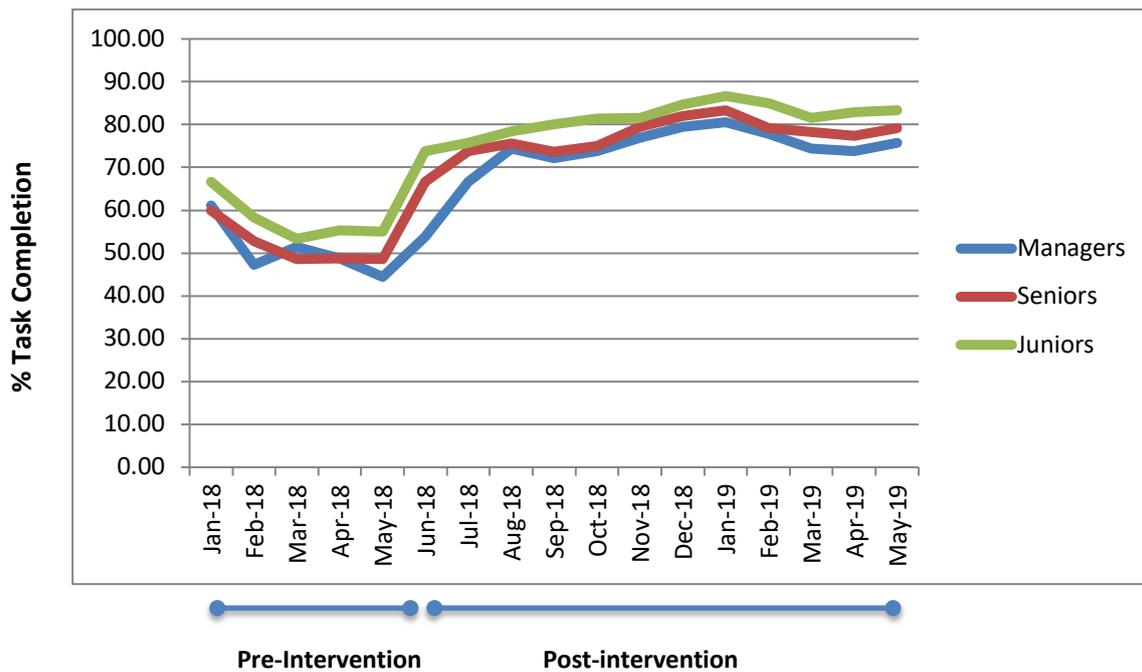
could be directly attributed to them (e.g., “I could not complete the turbidity parameters for manager review”) or when they took personal offence as in a team meeting (e.g., when the performance of juniors and seniors were criticized during the team meeting “What proof reading is it...I am sure second graders can do a better job”).

Conversely, the post intervention scenario witnessed higher self-ratings (‘1’ or ‘2’) under the ‘emotion/reaction’ category. Participants were often excited on completion of challenging assignments and put self-rating of ‘1’ as a consequence (e.g., upon successfully completing the eco audit, J stated “We did a good job and the team really supported...very happy”). Self-rating of ‘2’ frequently became the default position irrespective of task outcomes (e.g., “couldn’t finish the experimental CQA factor...will keep trying... it should be ok”). Besides signifying positive mood, it also demonstrated enhanced self-motivation to complete tasks.

Thus, during the pre-intervention period, ‘3’ signified task completion and ‘4’ indicated unsuccessful task completion within the ‘emotion/reaction’ category. On similar lines, during the post-intervention period, ‘1’ signified a successful task completion and ‘2’ indicated incomplete but progressive task attainment. This change on behalf of the participants in attributing a different task completion dimension to the self-ratings were due to the change in participant mood profile noted after the intervention (see 4.3.2.1 and Appendix 14).

By segregating the field data into the number of times participants recorded ‘1’, ‘2’, ‘3’ and ‘4’ in a month and upon subsequently analyzing the number of task completions across participants, I calculated the average task completion percentage for participants. Results indicated greater task attainment in the post intervention period across all positions (see Figure 4.2). Task attainment rates steadied in about 2 months post intervention and hovered around 80% that was closer to the average task completion rate of 78% as noted in literature (Sauro (2011) in Sauro and Lewis, 2016, p.41). Juniors exhibited superior task completion rates in the pre and post intervention period. The methodology adopted and working procedure has been shown in Appendix 8.

**Figure 4.2: % Task completed in a month**



#### 4.4.2.2 Participation and commitment

Findings in this sub-section evolved from the thematic understanding gained through the data code “participation and commitment” (see 4.1.2).

##### 4.4.2.2.1 Pre-intervention period

During the pre-intervention period, I observed minimal commitment and work participation with lesser degrees of personal engagement into the job roles. Excuses were frequently made to evade responsibility (e.g., “I don’t want to be in charge, too much food on my plate”, “my computer is slower than usual”, “ have a family commitment to address; please no time with me”), silence and non-participation were the norms in team meetings (e.g., *Managers commented, “Lazy fellows, absolutely no interest or preparation”, “zero solutions from the team”, I observed a lack of interest and participation in meetings*) and there was a lack of determination to deliver in the given timelines (e.g., *When participants reasoned and justified instead of acting on a task such as “ Have done more work than anyone”, “short of manpower”, “have been leaving late”*).

Non-adherence to work discipline was also observed with delays in submission, (e.g., “*Had K3 to complete - focused all my energies there*”), delays in entering into meetings (e.g., “*sorry I am late, was stuck in traffic*”, “*autos were less today*”) and unplanned utilization of holidays. Participants were also coming to terms through justification and no additional efforts (e.g., “*Had a lot of documentation to complete*”, “*going through the entire bunch was not practical*”), with reluctance to

stretch over-time (e.g., “Can’t stay back today”, “feel under the weather”, “sick and feverish”). I also observed a blaming culture, responsibility related arguments and a reactive behavior (e.g., “This was your duty not mine”, “You have to be responsible on your part”, “my schedules were delayed because of you”).

#### **4.4.2.2.2 Post-intervention period**

In the post intervention period, I observed traits that demonstrated increased commitment and participation. This can be seen through the incident noted in my daily log: *To gather field data on QBD, T, V, W, P, M undertakes exploratory data set analysis and conversations with market research firms. This was done at their initiative and executed within their fold. The managers did not oversee, guide or advice on the process. It was striking to see the enthusiastic faces and determination to create positive impact through an orderly attempt at collecting market information.*

Participants were eager to attempt proactively at challenging tasks (e.g., *when the work on cyclonic fusions was described as considerable work in a short time, participant stated, “it’s a customer requirement. We have no options...come what may, we have to get it done”*) and came forth voluntarily to spend over time hours to meet the target date (e.g., *When KLL tender submission was realized a day prior to the actual submission date, participants stretched their work timings without any arguments and rescheduled their calendars to put in additional efforts*). Participants were also keen to have more responsibility and work participation (e.g., *“I will be responsible for the clean room classes...no worries”, “I can have a look at the IT policy also...it is just a little more work”*) with an increased sense of commitment (e.g., *P volunteers to coordinate efficiency drive in the department. M offers to analyze dampeners; Q offers to improve HVAC and N offers to improve water utilization. The rest pitch in offering participation on a need basis*).

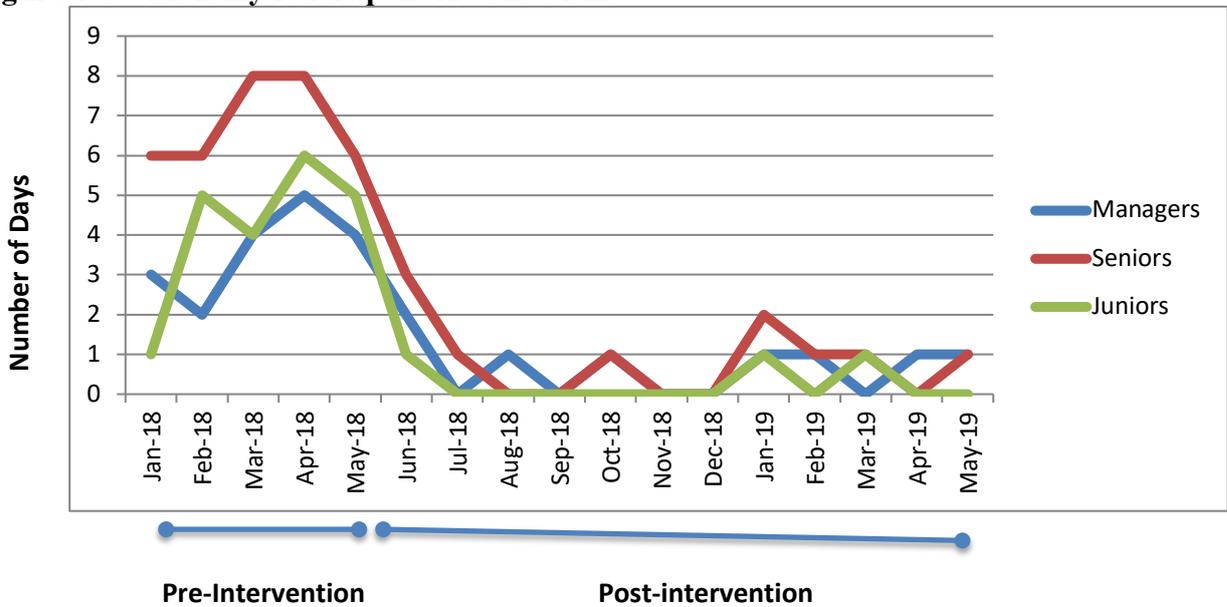
Increased dedication to delivering superior customer service was evident during one to one discussion (e.g., *M while engaging with the customer on the process parameters for cell culture collaborated with several domain experts and finally delivered a complete solution to the customer within a day*). Additionally, greater work discipline was observed with increased punctuality (e.g., *meetings almost always started on time with all the attendees present*) and reflections at self-improvement (e.g., *I overheard a participant regretting delay in submissions, “Found the language tough to comprehend...should have taken timely help...was foolishly overconfident”*).

Increased participation and commitment at work could also be observed from the reduced levels of absenteeism and increased working hours as noted against the pre-intervention period.

#### 4.4.2.2.3 Absenteeism

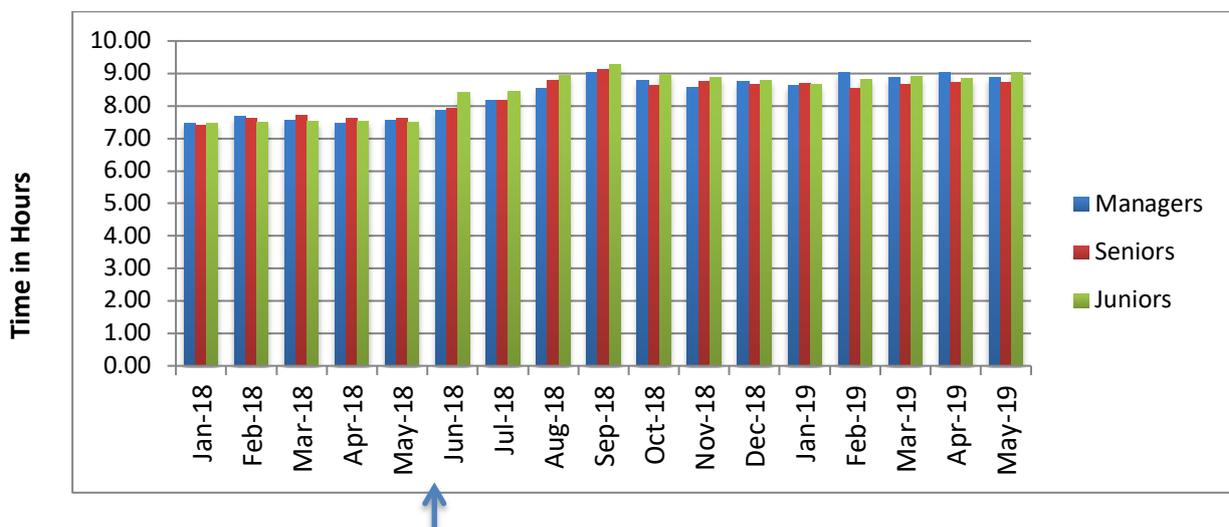
To determine levels of absenteeism in the pre and post intervention period, participant’s average monthly absenteeism was trended into a chart (see Figure 4.3 and Appendix 9). Results indicated reduced participant absenteeism after the intervention as shown below.

**Figure 4.3: Monthly Participant Absenteeism**



#### 4.4.2.2.4 Average Time spent at work

Average participant daily working hours in each month was charted below (see Figure 4.4 and Appendix 10). Results indicated that the average participant time spent at work increased in the post intervention period to an average of more than 8.8 hours in a working day.



**Figure 4.4: Average Time spent at work on a working day**

### 4.4.2.3 Task persistence and self-efficacy

This task execution trait advanced from the understanding gained through the data code ‘task persistence and self-efficacy’ (see 4.1.2 for the definition).

#### 4.4.2.3.1 Pre-intervention Landscape

Pre-intervention emotional landscape exhibited low task persistence and low self-efficacy. I gained insights into these attributes while co-working, during team meetings and one to one participant discussions.

I noted several instances of low self-efficacy and lack of self-belief within participants even before they attempted at a task (e.g., *“I don’t have the competency and I am failing on several occasions.”*, *“Short timelines scare me. I am not good in dealing with challenges”*, *“It is a very difficult task and I am certain I will not accomplish it within the deadline”*, and *“I will fail as I have in the past.... I am just not able to complete anything”*).

Similarly, lack of task persistence became evident with observed peer interactions that involved frequent conversations with superiors to communicate task completion issues citing comprehension difficulties and lack of time. This lack of task persistence was widespread in the team (e.g., *“I tried calculating the kLa factor for the last 3 hours but failed”*, *“It’s been almost 4 hours since I have tried fixing the macros...should we look for a person who knows excel very well”*, *“tried several times and I feel outsourcing the marcom brochures will give superior finish”*, *“microbial coursework is huge...spent a good amount of time...I will need support please”*). I also noted participants burning out quickly in the middle of task assignments (e.g., *L gave up on the process of compiling microbial coursework giving excuses, and entrusted N and P with the responsibility. They too habitually approached their superiors with task difficulties and sought clarifications*).

#### 4.4.2.3.2 Post-intervention Landscape

In the post intervention period, participants displayed greater confidence and self-belief while dealing with task challenges (e.g., *“Have 28 hours left...will be more than sufficient”*, *“I will give it a shot...should not take much time...my dexterity has improved considerably”*, *“looking to improve my self-record of churning pichia”*, *“Will manage. I wouldn’t need any further resource...you could allocate them to other priorities”*).

Greater task persistence was also evident with participant statements, (e.g., *“will keep trying until this grant gets through”*, *“failed in my attempt to maintain sterility...but on the positive have learnt each time, and before long will get it double verified. Sure”*, *“will keep looking for the Australia specific product liability*

*insurance policies*”, “Each time I do the documentation review, I am taking lesser time...mastered some shortcuts with each new assignment”).

### **4.4.3 Decision making**

Findings in this section progressed from the thematic understanding gained through the data category ‘Decision making’. The inclusion criteria for this category is defined in section 4.1.1. Based on the coding of observations during meetings, while co-working and participant narratives during one to one meeting; the thematic analysis classified this category into decision making time and alternative generation. These aspects have been elaborated in subsequent paragraphs below.

#### **4.4.3.1 Decision Making time**

This decision making factor advanced from the understanding gained through the data code ‘decision making time’ (see 4.1.2 for the definition).

##### **4.4.3.1.1 Pre-intervention**

Decision making during the pre-intervention period was often delayed and took considerably more time to adopt. Time taken for decision-making was understood from peer conversations (e.g., “Sir I had given you the options for stall sizes for your review last week. We need to give them a confirmation”, “ we had committed to choosing the design selection a week ago and the customer has been calling me up”, “waiting on your decision for repair or replacement of the boiler”), participant statements during one to one discussions (e.g., “indecisive...”, “has been vacillating on the background colour...spent days on it”, “listed the pros and the cons but it’s not black and white”, “ submission to DBT is overdue, because we need to make up our mind”, “ need to decide on the apportionment norms”), team assertions during meetings (e.g., “we need to place the order for the autoclave...its overdue...audit is next week”, “we are yet to submit confirmation for 1 week module delivery”, “We still need to decide on the lead coordinator”) and procrastination in decision making noted with group meeting conclusions (e.g., “we will think about it tomorrow”, three meetings ended with “we will finalize next week”).

##### **4.4.3.1.2 Post-intervention**

During the post intervention period, I observed that the time taken for decision making was lesser. Decision making during meetings was effectively reasoned out and organized into an action plan with lesser time spent in meetings for an outcome (e.g., when *L* raises concern on the

*lower clean air generation capacity in the lab. There is a unanimous agreement, and discussions veer towards achieving a constructive cost to benefit analysis).*

Operational decision making was also firm at an individual level to accomplish faster task completion (e.g., *“wasn’t fully clear...but just took a decision and moved on”*) and adopted quickly (e.g., *when the heater circuit was sputtering, immediate action was taken by the participants to preempt any breakdown, “Lets decide based on the information we have...have to submit the exemptions list without delay”*).

#### **4.4.3.2 Alternative generation**

During the pre-intervention period, difficulties in idea generation and creativity became evident with manager statements (e.g., *“no one thinks in my department”, “colleagues are dumb...cannot think”, “team cannot think. How can I spoon feed new ideas”, “Potential is high but we are not able to deliver. It is sickening no one has any ideas”, “essential to innovate but how is the question”, “I am unable to think”, “forcing myself to think”, “J held me responsible for lack of ideas”*) and seniors expressing their difficulty (e.g., *“restricted thinking and minimal progress”, “No time to think creatively”, “...trying to find solutions but my thinking is stuck.”, “future needs breakthrough ideas”* ).

Post intervention period saw increased initiatives and idea generation amongst the participants. I recorded several instances where participants contributed ideas and made new initiatives (e.g., *T and S share the idea of a S77 platform to improve customer feedback; S and U present a collaborated presentation where they divide the activities into 4 discrete lines; T, V, W meekly present market segments and align them to existing portfolios; M proposes a broadened multifaceted approach to impress a tough customer X; N proposes a lean service model with multiple ownerships for an individual; K, L launches DSP modules into the service portfolio; S, T present a prototype of an app that they envisage will facilitate continual background learning* ).

#### **4.4.4 Pro-social behaviors**

This section progressed from understanding gained through the data category ‘Pro-social behaviors’ with inclusion criteria defined in 4.1.1. Based on the thematic analysis this category was further classified into Backing up behaviors, Extra role behaviors, Team identity and conflict management (see 4.1.2) that have been elaborated in subsequent paragraphs below.

#### 4.4.4.1 Backing Up behavior

While co-working during the pre-intervention period, I observed a lack of backing up behaviors during participant interactions (e.g., *No voluntary offers of help were observed when participants struggled with experiments, with participants in close proximity turning a blind eye to the episode, not bothering to rectify visible procedural errors*). Even when participants requested help while co-working, they were met with excuses of time shortages (e.g., *When M requested help amongst participant colleagues for a module on mass transfer, “have a deadline tomorrow but an important family commitment”, participants walked away saying, “no time on my side buddy”, “have a client meeting”, “ sorry mate...no time”*).

During the post intervention period, I observed that more participants were willing to help their colleagues based on an empathetic understanding of the situation (e.g., *When P struggled to deliver thermodynamic calculations which became understandable with the hours he spent at a stretch on the desk, I overheard L saying, “Don’t worry hero...I will help you with the stats” and S saying “Leave the costing part to me”*). Participants also became more receptive and expression of personal difficulties became more common (e.g., *When O spoke about tooth extraction scheduled for Friday and expressed anxiety on delivering lecture on the next day, N offered help by saying, “Take rest tomorrow...I will take the lecture ...Give me your slides and I will do the rest”*).

#### 4.4.4.2 Extra role Behaviors

During the pre-intervention period, participants often had an individualistic sense of responsibility and did not exert beyond what was contractually expected of them. Arguments supporting my view were observed (e.g., *“This is not my job to be your steno”, “It’s your duty, not mine”, “you haven’t done what you are supposed to do”, “Its housekeeping’s job to keep the borosils clean not mine”*).

On the other hand during the post-intervention period, participants displayed wider execution ownership and became more collectivist to support common objectives (e.g., *Housekeeping leader while reflecting on their work had words of praise for the participants, “They keep everything clean and very cooperative...I have to give them the credit...we spend much lesser time cleaning the litter in the training building”*; *L, W raise concern on administration issues by saying, “It is painful to see dripping water and dry plants in our facility”*). Participants were also more forthcoming and discussed betterment and remedial measures in other departments of the organization (E.g., *S and U raise concern on noise levels from the production team and enquire, “would the customer find it ok”*), and were keen to undertake additional responsibilities at work that went beyond their respective domain

expertise and responsibility (e.g., when *O* and *S* voluntarily offered to take responsibility for designing the *JC* module. Their approach was beyond the motivation and sense of responsibility expected from their professional levels.).

#### **4.4.4.3 Team identity**

This pro-social behavior developed from the understanding gained through the data code 'Team identity' (see 4.1.2).

##### **4.4.4.3.1 Pre-intervention**

During the pre-intervention period, I overheard that team members did not appreciate and inspire one another (e.g., "*I am sure you wouldn't have completed Ch3 assignment. Have you*", "*this is intellectually demanding. Can you do this?*" "*I doubt you can complete it within the time frame*"), or contribute to larger collective goals that became apparent with participant statements (e.g., "*I have finished my portion*", "*what was allotted to me has been completed*", "*relieved my part is done*").

Similarly, success of one in the team was not celebrated and led to stray comments (e.g., "*what's the big thing*", "*nothing special. That was simple*", "*he is lucky to have got the right partners*") with no leveraging of individual strengths for achieving team objectives, (e.g., *despite T's excellent power point skills, the participant was not involved in making the presentation, cell counting qualities of S was not used during eosin staining.*). Participants also displayed lack of empathy for individual feelings and sentiments (e.g., "*I really don't care what your problems are*", "*this is the worst assignment given to me*", "*I don't want to hear your excuses*").

##### **4.4.4.3.2 Post-intervention**

Post intervention, there were increased expressions of care amongst team members for the training department. This resulted in increased appreciation and togetherness for efforts directed at achieving collective team tasks.

I noted more team celebration for individual successes even for activities outside their respective scope of involvement ("*Heard of your stellar customer ppt...Good job buddy*", "*wow...you were super quick man*", "*We were talking about you...Awesome performance*"). Participants were also eager to volunteer their individual skills for a team goal (e.g., *When the team was working to make the rmz quotation at short notice, 'U' stated, "I have made a shortcut using macros and the if function... we can save a good amount of time by using it"*) and the tone of conversations amongst participants became

more inspiring (e.g., *“just crack it buddy, you will come out with flying colors”, “come on people lets ace it”*).

#### **4.4.4.4 Conflict Management**

While co-working during the pre-intervention phase, I observed that meaningful discussions were rare and disagreements ended abruptly (e.g., *“I do not get your point, do as I say”, “Do this, period”*). Discussions were often taken personally by the receiving participant with a silent stride (e.g., *“ok”, “fine”, “right”*) and followed with gossiping one-liners while retreating to their desks with other team members (e.g., *“I don’t get it”, “doesn’t make sense to me”*). Misunderstandings ended with a bad taste, frequently requiring managerial intervention amongst peers (e.g., *“he isn’t cooperating and I can’t progress”, “I can’t work with him”, “Needs to be taught to listen to others point of view”, “thinks she knows everything”*).

In the post-intervention phase, conflicts were rare and the ones that occurred, ended swiftly amongst the affected participants who quickly diffused the situation (e.g., *When Q sounded aggrieved and voiced dissatisfaction on the weekly schedules, R immediately pacified the situation by saying “you don’t seem happy... give me until evening, I will try and make it comfortable for you”*; *When K held M responsible for the negative customer sentiment, I heard M state very calmly, “I have understood the situation and dealt with it yesterday itself. I wanted to walk you through the CAPA that I have initiated”*).

#### **4.4.5 Summary of productive behaviours**

Study findings suggested an increased prevalence of productive behaviors after the intervention. I noted an increase in communication amongst participants within the department, with other department members and external stakeholders. Task execution traits of participants improved with increased work participation and commitment, better personal attributes of self-efficacy and task persistence, and higher levels of ensuing self-rated task attainment. I also noted an improvement in decision-making capabilities with reduced decision making times and increased alternative generation. Similarly, pro-social behaviors within the training division became more common with increased instances of backing up behaviors and extra-role behaviors, higher levels of team identity and augmented application of conflict management skills.

## **4.5 Changes to success factors affected by Intervention**

Financial measures have been used to measure organizational success for many years (Maltz, Shenhar and Reilly, 2003; Dvir and Shenhar, 1992). However, frameworks that capture organizational perspectives beyond financial measures are needed for assessing organizational success. There is continuing struggle to define organizational success and as Hamel and Prahalad (1994) point out that for an organization to survive into the long term it must invest in the needs of its customers and predict their future requirements. Team skills and effective communication skills play a key role in this endeavor to engage with the customer (Ariyachandra and Frolick, 2008).

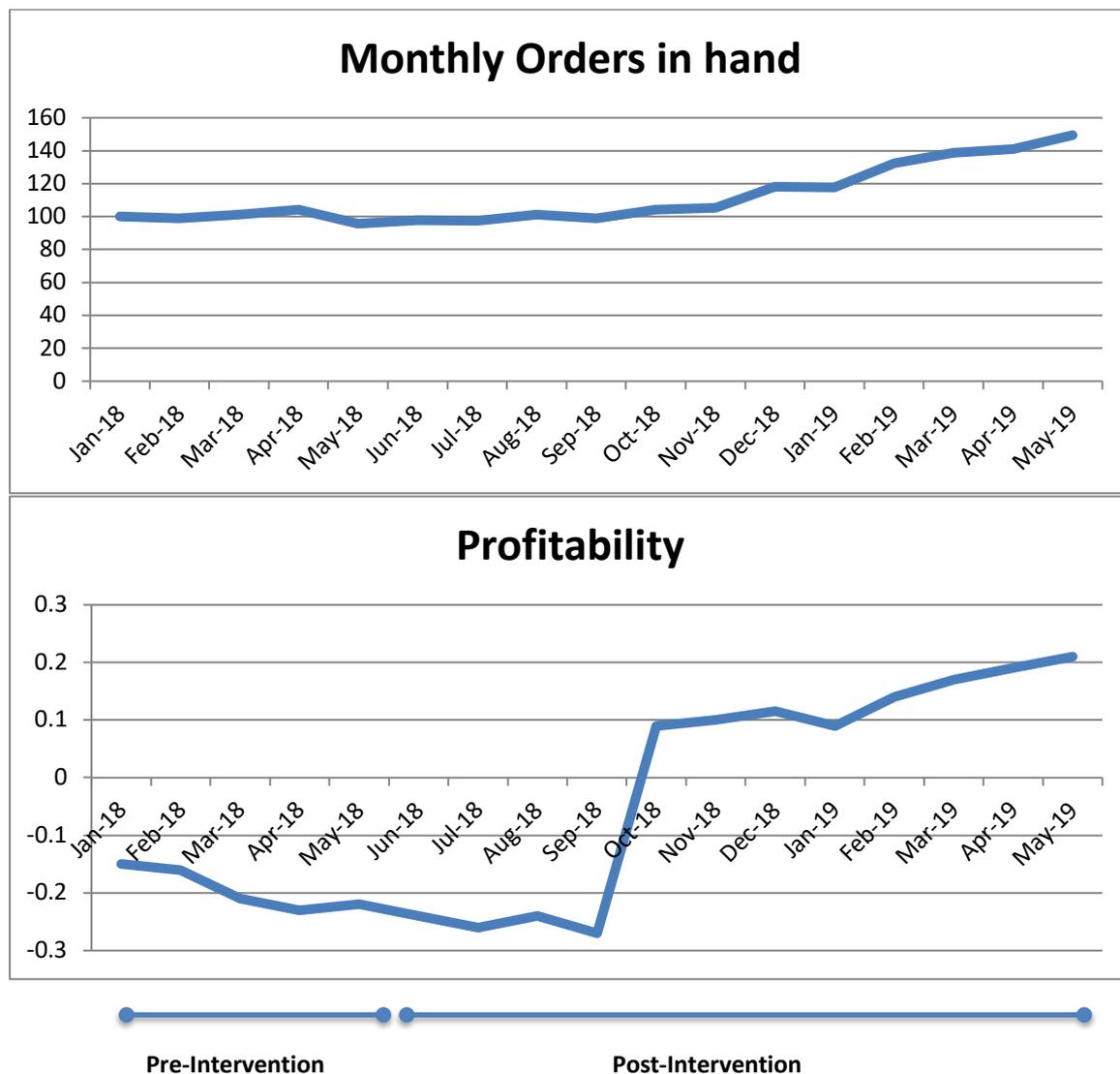
As success concept is multi-dimensional, dynamic and involves multiple stakeholders across time frames (Maltz, 2000), this study will analyze the financial, market, process, people, and future dimensions to measure organizational success (Maltz, Shenhar and Reilly, 2003). These organizational success dimensions have been used in several studies across research streams in marketing, economics, finance, product development and entrepreneurship. Since “different types of organizations should employ different measures of success” (Maltz, Shenhar and Reilly, 2003), I have chosen the parameters suitable for the organization under study.

### **4.5.1 Financial Measures**

This dimension includes sales and profits that represent the conventional approach to measuring organizational success. To analyze the financial situation, I obtained the monthly orders in hand and profitability figures of the organization. To protect organization confidentiality, the figures were rescaled with January 2018 considered as the base month for analysis. The working methodology and rationale have been explained in Appendix 11.

The results indicated an increase in monthly orders in hand and profitability after the intervention (see Figure 4.5 below). This can be attributed to the post intervention period when new revenue streams were postulated and implemented, and operational efficiencies achieved.

**Figure 4.5: Financial Measures**



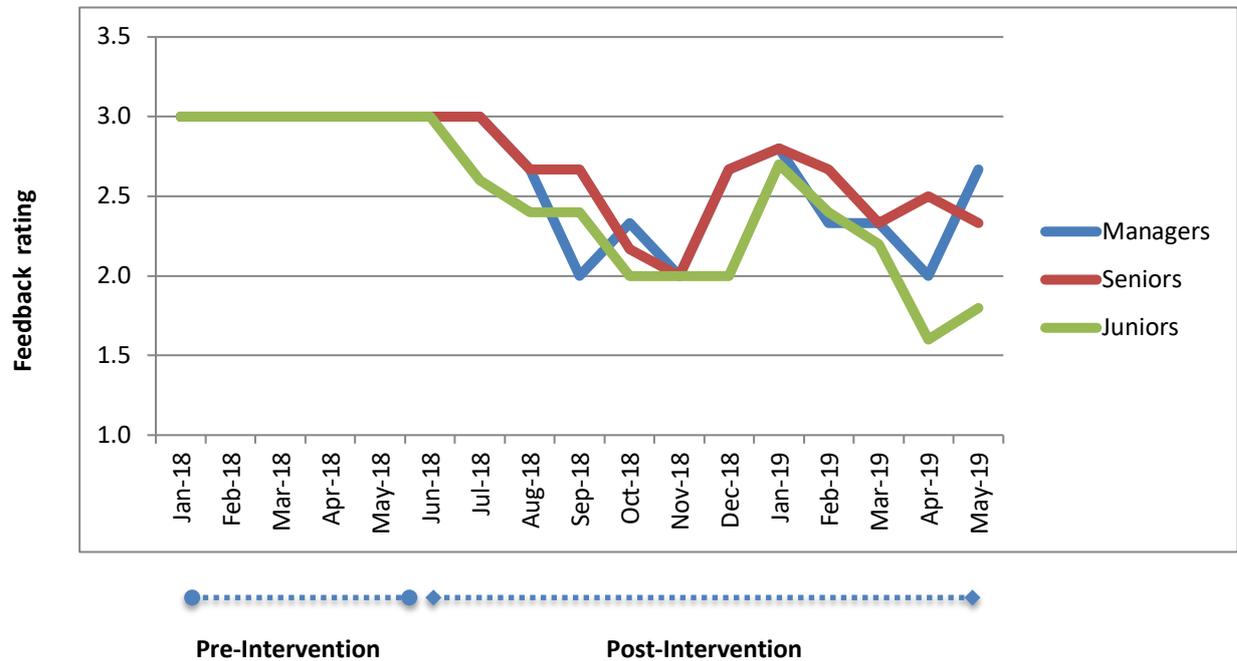
### 4.5.2 Customer/Market measures

This represents the relationship between a company and its customers. Customer satisfaction and service quality feedbacks are measures of this dimension. To quantitatively measure customer satisfaction, I collected customer feedbacks for each participant. They were then averaged into positions (i.e., Managers, Seniors and Juniors) and charted (see Figure 4.6).

As indicated during the qualitative study, customer feedback results showed an improvement in the post intervention period. However, they were not maintained consistently in the post intervention period possibly due to differences amongst customers, need to impress upon the customer to exceed their expectations and repetitive similar service deliveries to the same

customer. Juniors also enjoyed higher ratings compared to the managers and seniors. The methodology, working sheet and conclusions have been shown in Appendix 12.

**Figure 4.6: Customer feedback**

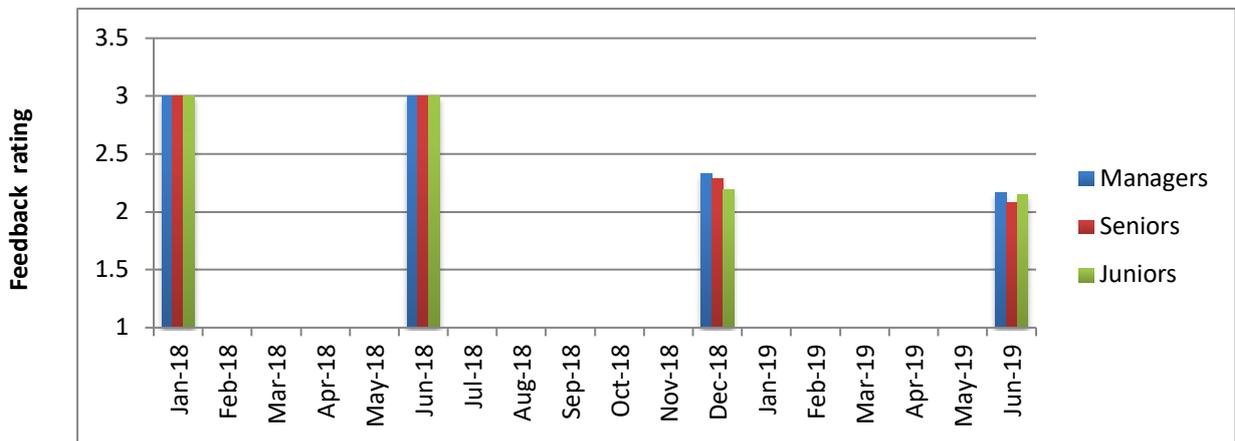
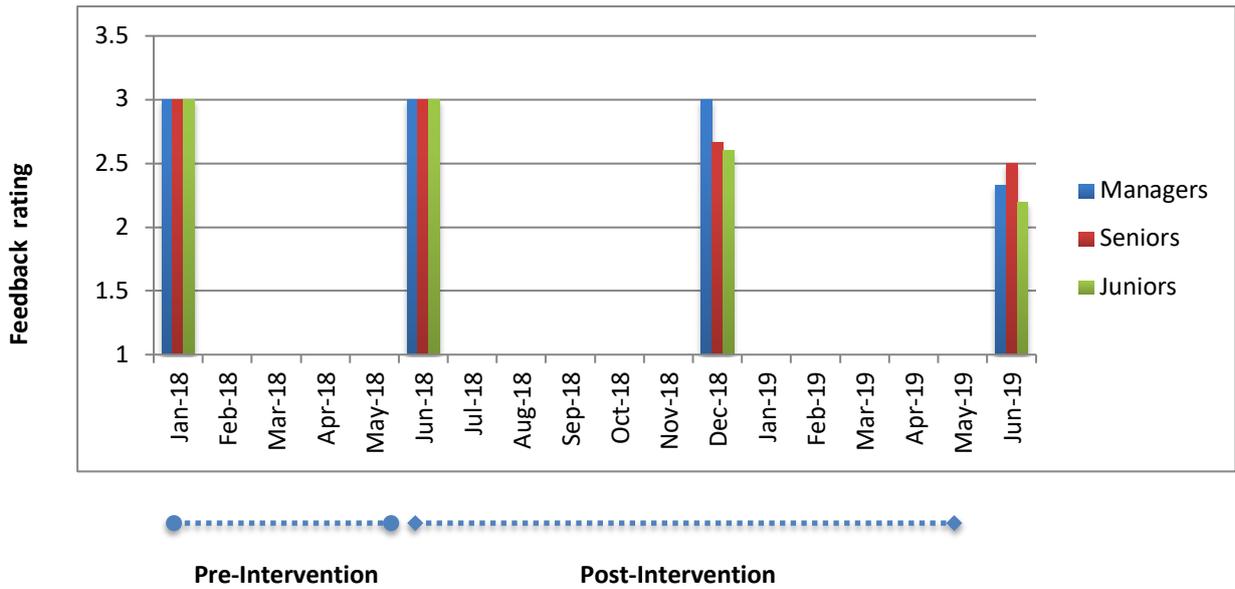


### 4.5.3 Process Measures

This represents the organizational efficiency achieved through team-based efforts driven at improving project management processes and adoption of standardized processes.

The organization under study measures process adherence of employees to established operational protocols such as ISO and ASME. This aspect is measured during the half yearly appraisal cycles in June and December. A total weightage of 10% of the appraisal is given for compliance to standardized processes. The remaining 90% of the appraisal includes performance measures to determine how well an individual or a team achieves its work objectives. To represent performance outcomes, I used supervisory performance ratings and self-rated goal attainment (Tsai et al., 2007). To maintain integrity of the managerial process, performance assessment measures were not discussed or referred to during the course of this study. I gathered information from the personnel portal and trended the results to look for patterns as shown in the chart (Figure 4.7, 4.8) below.

**Figure 4.7: ISO Compliance Ratings**



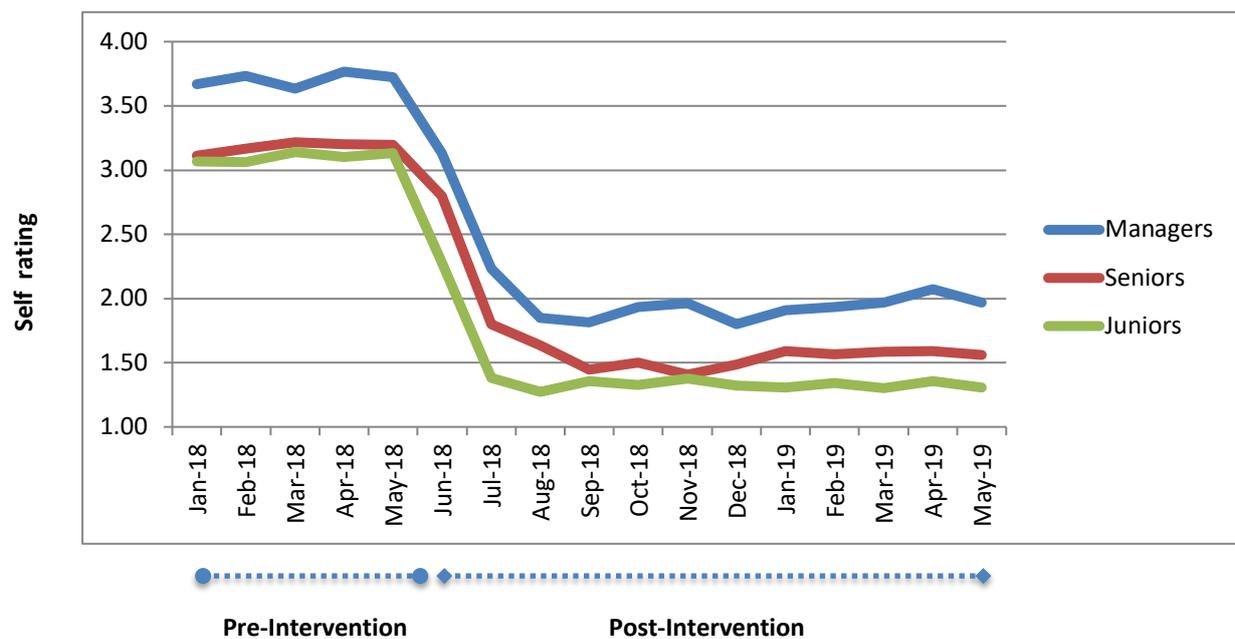
**Figure 4.8: Average Performance Ratings**

The results indicated that during the pre-intervention period, managers tended to give an average rating of '3 - Met Expectations' as the default supervisory rating for both process compliance and performance outcomes. Post-intervention, I observed better reasoned out supervisory ratings across participants for process compliance and performance. Participants were frequently rated '2 - Better than expected' in the post intervention period. There was also increased constructive communication between the line managers and their direct reports during this period. The procedure adopted and findings have been explained in Appendix 13.

## 4.5.4 People Measures

This represents the role of employees in organizational success. Measures include surveys of employee satisfaction and wellbeing, and employees suggesting and testing new ideas. As wellbeing and satisfaction is typically operationalized through self-report measures of happiness and mood states (Yardley and Rice, 1991), the data is used to trend participant wellbeing. Building on the qualitative findings (see section 4.3), self-ratings in the category Mood state (Innate) was plotted to understand employee wellbeing (See Figure 4.9 and Appendix 14). As shown below, the results indicated a shift to positive mood states post intervention, suggesting improved wellbeing amongst participants. The positive effects of the intervention pervaded across positions. However, in line with the qualitative findings (see 4.3.2.1), managers frequently assigned a rating of ‘2’, seniors positioned themselves between ‘1’ and ‘2’ and juniors often rated themselves ‘1’ during the post intervention period.

**Figure 4.9: Mood States – Self ratings**



## 4.5.5 Future Preparation Measures

They recognize the importance of foresight in an organization. This dimension involves indicators of alliances and partnerships, ability to innovate, investments in new markets, and forecasting and preparing for changes in the business environment. Therefore, I analyzed New Alliances, Partnerships and Memorandum of Understandings formed by the training division during the study period.

I observed no new alliances and collaborations in the year 2018. Beginning 2019, there were several proposals for collaborations from across participants that fructified into three alliances until the period ending June 2019. One of the alliances was for a new service delivery to be co-developed in anticipation of a shift in the future industry demand scenario. Thus, the post intervention period indicated greater flexible thinking towards future preparation initiatives.

#### **4.5.6 Summary of success factors**

Modifying the workplace built environment space based on concepts in Eastern architectural practices seems to have had a positive influence on organization success factors. Financial metrics, customer measures, process compliance, employee satisfaction, and proactive preparation for the future showed an improvement post intervention.

### **4.6 Conclusion of Intervention study findings**

Study findings presented in this chapter with observations and secondary data pertaining to the research questions framed in this study, provided knowledge on areas that were potentially impacted by changes in the built environment space configuration. I noted saturation in the positive effects observed during the post intervention period against the tribulations outlined in the pre-intervention period. No new themes or organizational matters of a different nature emerged during the end of the study period.

Findings highlighted that the configuration of the built environment space can moderate the occupant moods and emotions, which in turn can influence the productive behaviors exhibited at the workplace and the resulting organizational success factors. The findings also help to understand everyday workplace challenges, evolving social relations and differing reactions to similar situations with changes in the affect profile. Chapter 5 will interpret these study results, provide recommendations for practice and opine suggestions for future research.

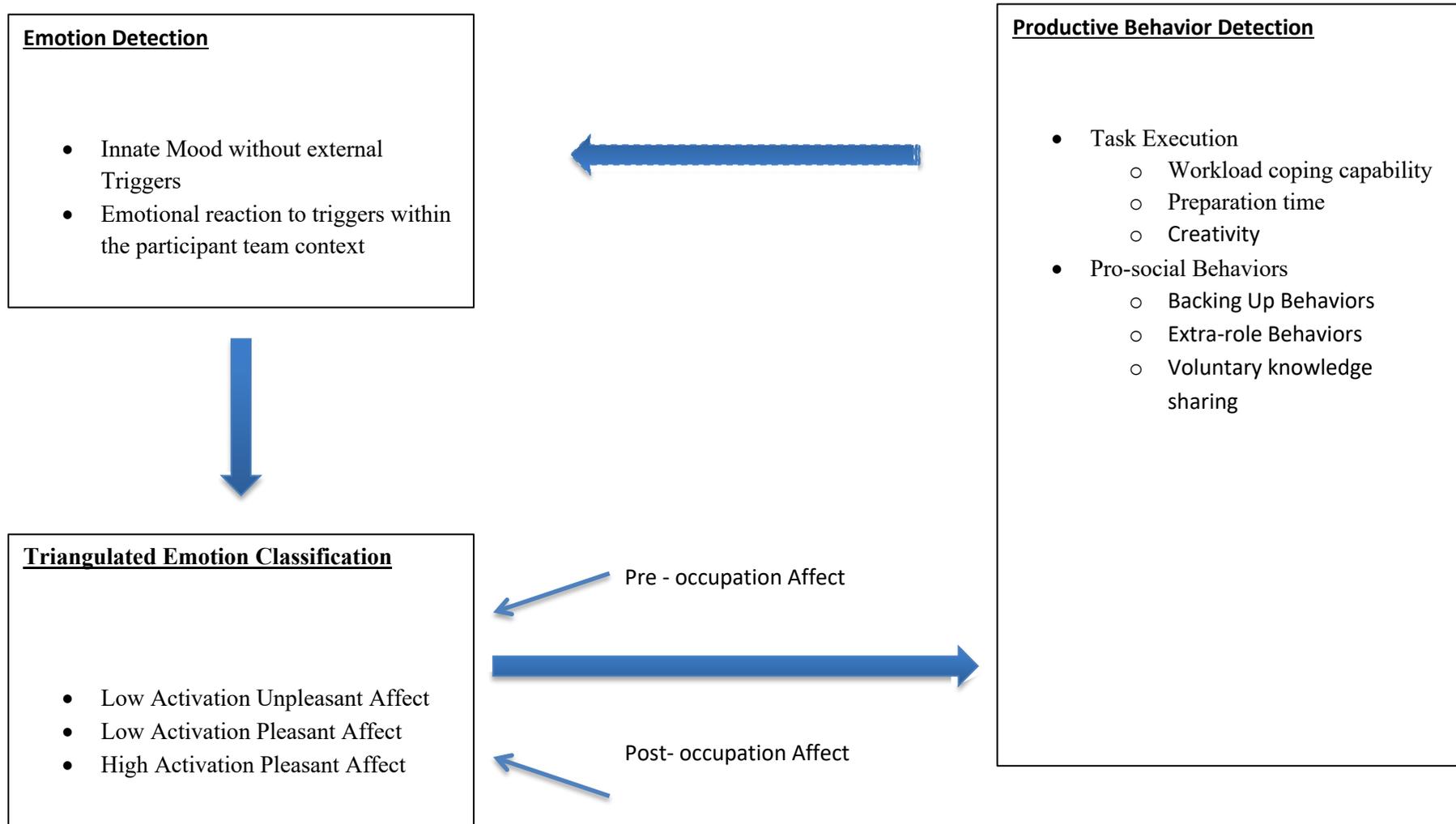
## 4.7 Developmental study Findings (Study 2)

The goal of this study was to determine the organizational impact of applying the integrated design model to a new green field built environment. The study aimed to determine practicality of applying the integrated design model (see 3.3.6.4) in an organization context, increase practitioner relevance (see 5.5) and meet the fundamental purpose of the study (see 1.2). To make the thesis coherent and structured for the reader (Golding, 2017), Cottrell (2017) advised against unnecessary repetition of critical thinking analysis. As indicated in the study design (see 3.1), similar data collection and analysis methodologies were adopted for both the intervention and developmental studies. Through the process of data analysis, I could connect field data with concepts in literature (Bowen, 2005) that were similar for both the intervention and developmental studies. As the intervention study reported on the theoretical rationale, presentation details and findings, this section only makes a brief mention of the conceptual underpinnings where relevant.

Findings on the research questions (see section 1.1.5) were organized around categories that developed during data analysis (see 4.1). Similar to observations in intervention study, I observed a positive change in the affect profile of participants in the new built environment. Though the developmental study participants enjoyed a pleasanter affect profile in the prevailing old built environment (see 4.7.1.1) compared to the intervention study participants, changes in mood, emotions and productive behaviors were palpable. As noted and explained in the interventions study findings (see 4.2), I noted a similar increase in productive participant behaviors with positive affect, and positive productive behaviors in turn promoting positive affect during the study period in the new built environment.

The themes that emerged from pre-occupation (old built environment) and post occupation (new built environment) field study, and holistic effect of new built environment on study participants is shown below (see figure 4.10). The following sections reflect on these findings, and trace the transition into an increasingly positive participant affect profile and proactive behavioral characteristics at the workplace environment.

**Figure 4.10: Snapshot of Developmental study findings**



## 4.7.1 Moods and Emotions in Developmental study

This section discusses the participant emotional landscape in the old production built environment and chronicles the changes in the new production built environment. Study findings are a triangulated convergence of participant self-ratings, discussion on their states of wellbeing and participant account of recorded observation in my daily log.

### 4.7.1.1 Affect landscape in the existing built environment

I found that the prevailing affect within the old production built environment was generally pleasant. However, they became neutral and occasionally unpleasant during task executions. The vast majority of participants opted for a '2' or '3' in the self-ratings scale. Thematic analysis yielded further insights into the prevailing mood and emotional states. I detected mood states becoming apparent during periods when project related production activities were minimal and participants could not attribute causations for their self-ratings. Emotional states and reactions on the other hand became ostensible while in the midst of production cycles that were in line with project schedule at the organization.

#### 4.7.1.1.1 Prevailing Mood state

This unit describes participant mood states in the old built environment.

#### Manager, Senior Engineer and Engineers

Participants across positions presented a mood state that was generally low activated and pleasant. They often reported self-ratings of '2' in situations without any apparent work related stimuli and could not attribute specific causations for a particular mood state. Upon prompting for participant reflections on their mood state with questions such as (e.g., "*How are you*"; "*you felt happy...good...any reasons you think you were happy*"; "*see you smiling always...what's the secret*"), they voiced statements that indicated **contentment** (e.g., "*feel nice as always*"; "*ya everything's good*"; "*just love the scent of the rain... awesome no*"), **being at ease** (e.g., "*sakath agee idhae*" (*translates to feeling excellent*); "*everything is planned...no tension...so feel lovely*") and **relaxed** (e.g., "*just feel calm and met the APBL schedule... maybe the reason*", "*Don't know, I just felt that way*"). When I queried further to gain more understanding of the mood states with my thoughts (e.g., "*so you feel happy ...if I can ask any reason as to why you gave a '2' and not a '1'*?"), they replied, (e.g., "*there was nothing extraordinary*"; "*I was not so so happy...just 2*"; "*just happy but not very very...so 2*").

#### 4.7.1.1.2 Prevailing emotional state

This unit describes the participant emotional reactions to unsatisfactory situations and work challenges in the old built environment. Through thematic analysis, I found differences in emotional intensities based on levels of seniority.

##### Manager and Senior Engineer

I observed that supervisors often had a low activated unpleasant affect profile while addressing complex task responsibilities. Such situations were also most likely accompanied by a self-rating of '3' on such days. During such unfavorable situations that required stretching beyond normal routines while delegating and supervising, acting on unforeseen eventualities and attending to incomplete work targets; participant narratives of wellbeing were **tired** (e.g., "*motivating myself... I am done after explaining the same thing over and over again to the coordinating engineers*"), **depressed** (e.g., "*I feel low...no ones cooperates*"; "*few of us work...others don't care...put zero efforts*"), **Dull** (e.g., "*struggling to think of ways to overcome the ferrite problem*"; "*I don't know what it is...my plan always changes last minute*"), **sluggish** (e.g., "*getting tougher to manage people*"; "*tough to cope with the customer deadlines*"), **grouchy** (e.g., "*only if my team was better, I could avoid so many problems*"; "*common sense is so uncommon*") and **bored** (e.g., "*it's like talking to the walls...what's the point in delegating*"; "*Customers never acknowledge...Many times feel most of my work is a waste of time*").

##### Engineers

Engineers mostly presented low activated and neutral emotion states with self-ratings of '3' during unfavorable situations and criticisms from colleagues. Their narrative of work related wellbeing during one to one discussions were **Quiet** (e.g., "*I am ok...nothing*"; "*work did not go as I hoped*"), **Passive** (e.g., "*I have done what boss has told me to do...although I feel TIG is better*"), **inactive** (e.g., "*don't feel like exploring and move forward*"; "*finished my part exactly, although overall project is lagging...don't want to be part of blame game*") and occasionally **idle** (e.g., "*don't know where to start*"; "*stuck...I have been allocated work that is not doable...I am not superman*"; "*there is so much work...but not doing anything*").

#### 4.7.1.2 Affect landscape in the new built environment

In the new built environment, I found that the participant affect profile became more activated and pleasant after about a month post occupation. Participant self-ratings also

showed more '1s' during the corresponding period and positive affect profile persisted throughout the remaining period of the study. As a shift in affect environment was noted across participants, improvements in individual mood states and changes in intensity of emotional reactions to unfavorable situations became evident through thematic analysis.

#### **4.7.1.2.1 Mood state**

This unit describes post occupation mood states in the new built environment. Study participants presented variations in individual mood states as shown below:

##### **Manager and Senior Engineer**

Mood states of supervisors almost immediately changed to high activated and pleasant profile after occupation of the new built environment. Although I initially attributed this phenomenon to the possibility of “employees' excitement about their new work environment” (Singh et al., 2010) and Hawthorne effect, to explain possible temporary occupant perception bias of their satisfaction in the new built environment (Stand, 2000); shift in mood profile to increased pleasantness persisted throughout the remaining part of the study period. I also observed an increased number of suggestions for process improvement and requests to support self-inspired initiatives during this period. Days when participants were not addressing major work related contingencies were often expressed with self-ratings of '1' and participant narratives indicated being **joyful** (e.g., “*Feel lovely*”; “*last few weeks were very good*”; “*it's not work related but you got to try Sante...ambience is awesome*”), **Inspired** (e.g., “*we should increase production*”; “*JFDA not a problem...lets have projects...we just have to fine tune production flow*”), **excited** (e.g., “*trying argon instead of nitrogen for purging...waiting to see the result*”), **enthusiastic** (e.g., “*beautiful process primers online...actually learnt something each time*”), and **lively** (e.g., “*thinking that all of us wear colorful theme attire for Diwali*”).

##### **Engineers**

Mood states of engineers improved to high activated and pleasant after occupying the new built environment. However, this change was noted after about a month post occupation and then stabilized during remaining part of the study period. During the initial period for about three weeks post occupation, participant mood states worsened to a neutral and often low activated unpleasant affect profile with concurrent self-ratings of '3'. During this period, participants indicated a **depressed** (e.g., “*feel little down*”; “*don't feel so happy*”; “*friends not around during tea time*”), **sluggish** (e.g., “*not able to work well*”; “*feel everything and myself slow*”), **passive** (e.g.,

*“I am not feeling active”; “don’t feel like doing anything”*) and **bored** (e.g., *“don’t have the josh”*) outlook.

After about a month post the occupation, Mood profiles then changed to high activated pleasant affect profile with participants frequently indicating states of **excitement** (e.g., *“awaiting the feedback on aesthetics...my gut feeling is they will jump”; “feel very happy...don’t know why actually”*), being **Inspired** (e.g., *“we need more work...capacity utilization should increase”; “we have to be the best”*), **enthusiastic** (e.g., *“I feel happy with more challenges...looking forward to solving the IG problem”, “feedbacks are very useful...we can learn so much”*), and **elated** (e.g., *“started monthly excursion parties...just super”; “volunteered...my time management became better!”; “intense burst of happiness...not sure the reason”*).

#### **4.7.1.2.2 Emotional reaction to unfavorable situations**

This unit describes the post occupation emotional intensities of participants to unfavorable situations. There were participant group variations as shown below:

##### **Manager and Senior Engineer**

Supervisory participants generally presented an activated and pleasant affect profile with self-ratings of ‘2’ while dealing with challenging situations in the new built environment. Their approach became apparent during conversations when participants narrated incidences that indicated being **interested** (e.g., *“ just read in books...will try and tackle oxidation challenges with temperature regulation”; “they have been struggling...looking for avenues to reduce their burden”*), **inspired** (e.g., *“I told them don’t worry...mistakes do happen...it’s about having the courage to keep trying”; “...you were just delayed once...there is always the next time”*) and **determined** in difficult situations (e.g., *“ come what may we will meet the time line...24 hours is what we have and we are young”; “all of us will win together”; “let’s see we will do everything to meet the customer schedule”*).

Occasionally when instructed objectives were not met, they would momentarily become low activated (be quiet and introspective), express **calm** dissatisfaction and subsequently find ways to motivate and get work done (e.g., *“its saddening right, please don’t repeat next time...at least keep me informed”*). I observed several occasions where supervisors motivated and **inspired** engineer colleagues to ease the challenging situation (e.g., *“we can guys...if not us no one can”; “we are not at fault completely...so champs let’s start running the marathon”*).

## Engineers

Similar to the mood states, during the initial days of occupation in the built environment for about 3 weeks, participants presented a low activated unpleasant affect profile while dealing with unfavorable and challenging situations. They were often **grouchy** (e.g., “*basic things are not there...how can boss expect us to finish in a week*”; “*my team is not supporting*”), **dull** (e.g., “*the problem has no solution*”; “*estimation is difficult as data is not available*”) and **sluggish** (e.g., “*targets given are unachievable*”; “*Executing MEG will take time*”; “*quality will take more time*”).

This however shifted to a high-activated pleasant emotional profile within about a month post the occupation with participants alluding to an outlook that was **inspired** (e.g., “*our situation is so much more better compared to TKG...I am confident we will get there*”, “*nothing is impossible*”), **determined** (e.g., “*Challenge...we will keep trying new methods till it functions*”, “*there are so many permutations and combinations...will soon click 100%*”), **enthusiastic** (e.g., “*we will spend over time and make the customer happy*”; “*I have to make it shine and wow them*”) and **Interested** (e.g., “*BN’s advice in improving equipment productivity makes complete sense...will try to adopt for us too*”). I noted that such positive emotional states endured during the remaining part of the study.

### 4.7.1.3 Summary of Mood and emotion findings in developmental study

In the new built environment, I observed a positive change in the participant affect profile. Prevailing mood states of participants in the old production built environment were pleasant but low activated. Moreover, emotional reactions of participants to unfavorable work situations were unpleasant for supervisors and neutral for engineers. Post occupation of the new built environment, I observed a shift in affect profile to an increasingly activated pleasant phase that took different approaches and time to realization based on positions and responsibilities.

**Supervisors (Manager and senior engineer)** presented a pleasant and low activated innate mood profile in the old built environment that was defined by contented, relaxed and at ease characteristics. However, during challenging situations within the department, their emotional profile became unpleasant and low activated with expressions and responses that were tired, depressed, dull, sluggish, grouchy and bored.

Once in the new built environment, their mood profile soon changed to a high-activated pleasant phase that became apparent with increasing instances of being Joyful, Inspired,

Excited, enthusiastic and lively for no specific attributable reasons. Similarly, during unfavorable situations within the production department, their responses and outlook became interested, inspired and determined with a high-activated pleasant emotional profile. Occasionally, however when subordinates disregarded duty and protocols, there were instances of low activated emotions with brief periods of quietude before bouncing back into high-activated pleasant states.

**Engineers** similar to supervisors presented a prevailing mood profile that was pleasant and low activated with a laid back demeanor in the old built environment. However, addressing difficult situations at the workplace was met with low activated and neutral emotion profile that manifested into a quiet, passive, inactive and idle outlook.

In the new built environment, occupant engineer mood states initially worsened to a low activated unpleasant affect profile that was expressed with a depressed, sluggish, passive and bored temperament. This unpleasant outlook lasted for about a month, subsequent to which the occupant mood states improved to a high-activated pleasant affect profile that was marked by an excited, inspired, enthusiastic and elated character. Similarly, emotional intensity to unfavorable situations followed the corresponding mood profile states with occupant engineers initially demonstrating low activated unpleasant affect profile underscored by dull, grouchy and sluggish responses. However, after about a month, emotional reaction of engineers like mood states reverted to a high activated and pleasant state with participants demonstrating inspired, determined, enthusiastic and interested traits while dealing with challenging and unfavorable situations. Study findings with related data codes have been summarized in the tabulation below (Table 4.2):

**Table 4.2 Summary of mood and emotion findings in developmental study**

<b>Affect States</b>	<b>Participants</b>	<b>Old Built environment Affect</b>	<b>Codes</b>	<b>New Built Environment Affect</b>	<b>Codes</b>
<b>Mood</b>	Manager, Senior Engineer	Low Activation Pleasant	Contented, Relaxed, At Ease	High Activation Pleasant	Joyful, Inspired, Excited, enthusiastic, lively
	Engineers	Low Activation Pleasant		Initial Neutral and Low Activation Unpleasant to	Depressed, Sluggish, Passive, Bored
				High Activation Pleasant	Excited, Inspired, Enthusiastic, elated
<b>Emotional Intensity</b>	Manager and Senior Engineer	Low Activation Unpleasant	Tired, Depressed, Dull, Sluggish, Grouchy, Bored	High Activation Pleasant	Interested, Inspired, Determined
				Occasional and brief Low Activation to	Calm and Quiet
				High Activation Pleasant	Inspired, Determined
	Engineers	Low Activated and Neutral	Quiet, Passive, Inactive, Idle	Initial Low Activation Unpleasant to	Grouchy, Dull, Sluggish
				High Activation Pleasant	Inspired, Determined, Enthusiastic, Interested

## 4.7.2 Changes to productive behaviors in new built environment

Findings in this section advanced from thematic understanding gained through the data category 'Task execution'. Based on the coding analysis of participant narratives under 'emotion/reaction' and corresponding assessment of self-rated wellbeing scores, task execution traits could be classified into workload coping ability, design preparation time and creativity. Similarly, thematic understanding of data category "pro-social behaviours" yielded understanding on voluntary knowledge sharing and backing up behaviors at the workplace.

### 4.7.2.1 Workload coping ability

In the old built environment, workload perception was a dominant factor in the participant evaluation of wellbeing. During work assignments, participants frequently allocated ratings of '3' to define their state of wellbeing. Although work completion was never highlighted as a concern, quantum of work and time available to execute seemed to be a pressing source of anxiety generation. Participants frequently voiced the need to multi task to meet production targets and their inability in doing the same (e.g., "*I can just focus on one thing at a time...the load we have now, we have to juggle*"; "*Many things to do...and I feel better doing one thing at a time*"; "*feel overwhelmed with the tasks at hand*"). Ongoing performance defined as success in achieving daily goals (Paterson, 2010) also negatively influenced the perception of total workload (e.g., "*I have not finished anything yesterday...have lots to do*"; "*lagging behind in the plan*"; "*catch up thoughts*"). Participants also struggled with focus when they mentioned challenges in attention (e.g., "*not able to concentrate...many things*"; "*which one to prioritize*"; "*everything is urgent*").

In the new workplace built environment, I observed reduction in workload perception with participants increasingly indicating self-ratings of '2' to express their states of wellbeing. I noted better workload coping abilities with participants indicating better multitasking attributes (e.g., "*work is fine...I am working on four no five projects now...good going*", "*was working on the 3d yesterday and SS has a host of requirements...interesting to see them say different things*"; "*it's a breadth of experience ...got into design, project management and costing...its marvelous*"), improved ongoing performance (e.g., "*as per plan*"; "*on track with the target...could finish large parts last week*"; "*feel a lot more productive...have time*"; "*dealing with it systematically, so cool*") and broader attention focus (e.g., "*much clearer after the deep dive*"; "*focusing on JK first because their piping is simple and want to get it out of the way*"; "*takes just 2 days for shipment...so will prioritize LP last*"; "*it's about paying attention to all parameters...simple*").

#### 4.7.2.2 Preparation time

In the old built environment, several participants lamented on the time taken for preparation versus execution (e.g., *“inappropriate amount of time is spent on preparation”; “fabrication work is ok but we are not releasing design drawings fast enough”*). On closer analysis, it became apparent that participants continued preparation procedures despite completion (e.g., *“thinking of all other stress-strain possibilities...I know it’s time...its complete but last bits”; “ checked the design...but want to ascertain heat factors maybe”; “KM has signed off...have to go through design calcs”*).

In the new built environment, I noted faster preparation time before execution (e.g., *“design template given in record 2 days”; “all prepared...planning for vinci project sent”; “looking to reduce the design days less than one...trying but let’s see”*). On analyzing further, participants were more confident (e.g., *“our FAT preparation is the most exhaustive...I am sure no one will do all this analysis that we are doing”; “our processes are foolproof”*) and willing to take greater risk (e.g., *“ got pre-testing protocols approved on time...worst case scenario was factored in so why think further”; “I just told him go ahead with three leg design...I think it is perfect...will see if they raise an objection”*).

#### 4.7.2.3 Creativity

Conversations with participants while they occupied the old built environment did not decipher any challenges with execution and the theme of creativity did not become apparent during conversations with the researcher. In the new built environment, participants commented on increased use of shortcuts to increase work efficiency (e.g., *“ realized that acid wash is better than colin...so avoiding colin now”; “buffing straight with the coarse grade then step approach...fine finishing done last to 0.4 Ra”*), better task organization through associations (e.g., *“I made an excel sheet to simplify line size calculations that keep recurring”; “segregating the storage of 35 and 04 steel, so that we can save time”*) and displayed greater cognitive capabilities while finding solutions (e.g., *“I feel weld yellowing happens when there are impurities in argon...feel we should try the 99% pure...whenever we tried the 95% one, more rejects...I confirmed”; “Found greater purging time gives better bead consistency...should have realized this long time ago”*).

#### 4.7.2.4 Pro-social behaviors

In the old built environment, observations and participant narratives revealed a blaming style of communication as suggested by McLendon and Weinberg (1996). A few of the instances I noted were (*“maintenance people did not do their job”; “I had given them the solution but they did not listen”; “he didn’t do his part well...what could I do”*). I also noted minimal voluntary knowledge

sharing within the group (Kumar et al., 2007; Cai and Xu, 2008) with participants eager to protect their personal improvisations and improvements (e.g., *“didn’t share this method with anyone... I have spent so much time on it”*; *“don’t feel like sharing this shortcut...I mean no one gave me a solution, I figured on my own”*; *“he will finish his part on time...we will not be affected...let him do it rather than making it easier ”*). Participants also mentioned instances where they did not exert beyond the allocated call of duty or volunteered assistance (e.g., *“ my buffing part is over...I have been waiting for him to finish his buffing part to start assembly”*; *“I finished AB wiring in a day...No clue why A.N. is taking so much time”*; *“My sense is his syncing method is not right...he should figure out”*).

In the new built environment, participant narratives pointed to an increasingly harmonious team spirit of joint effort to alleviate difficult situations, rather than blaming and holding others responsible (e.g., *“glad the project went on time...all pitched in”*; *“Maintenance guys were on leave...we replaced the diaphragm”*; *“everyone in the process team was occupied...so attempted at resolving the CIP cycle ourselves”*). Participants also discussed on increased informal knowledge sharing within the group (e.g., *“ C gave me a detailed crash course on his welding method...saved a good amount of time”*; *“E’s summary of design formulas made work super simple”*; *“higher purging time made all the difference...F’s technique out of the world”*) and recounted increased incidences of backing up behaviors (e.g., *“ ...wouldn’t have happened but for H and I supporting”*; *“luckily G was available and could complete on time”*; *“...sorted bills on time with their assistance”*).

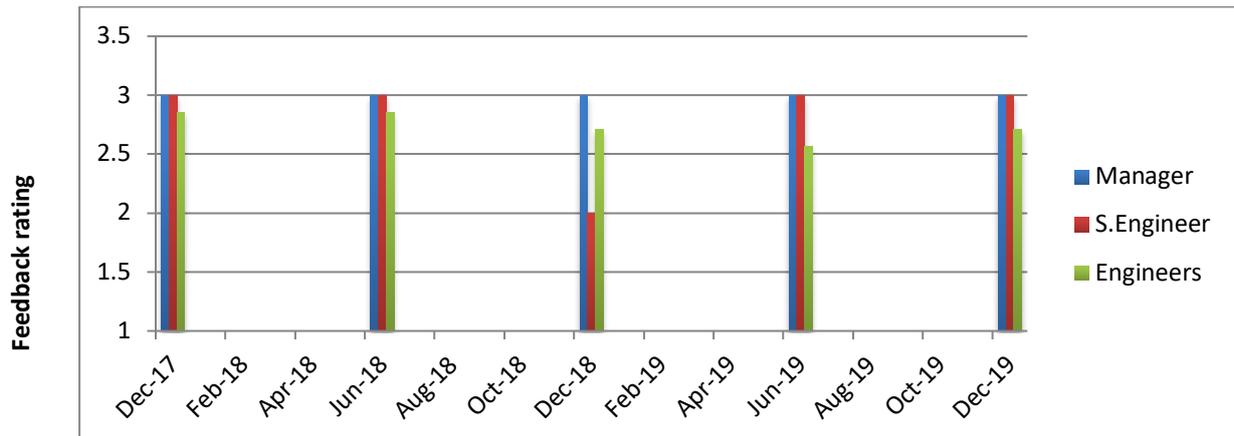
### **4.7.3 Changes to success factors in the new built environment**

Positive changes of varying degrees in process and people measures were observed in the new built environment.

#### **4.7.3.1 Process Measures**

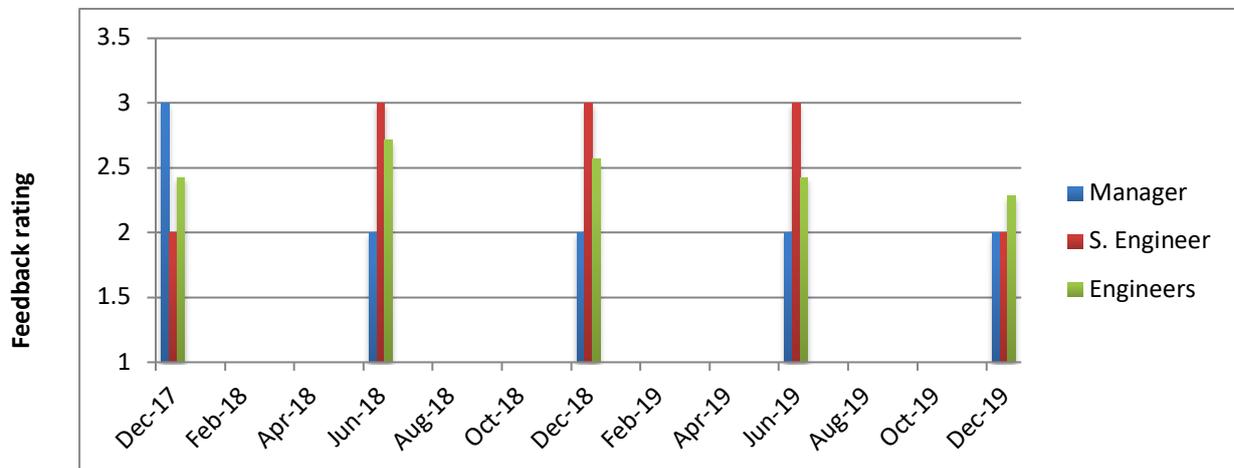
To identify situation applicable process measures, supervisory ratings during the half yearly appraisal cycles in June and December were retrieved from the HR portal and analyzed. The ratings were segregated into performance measures and ISO compliance, and subsequently charted with position averages for identifying patterns as shown below:

**Figure 4.11: ISO Compliance Ratings**



Old building

New building



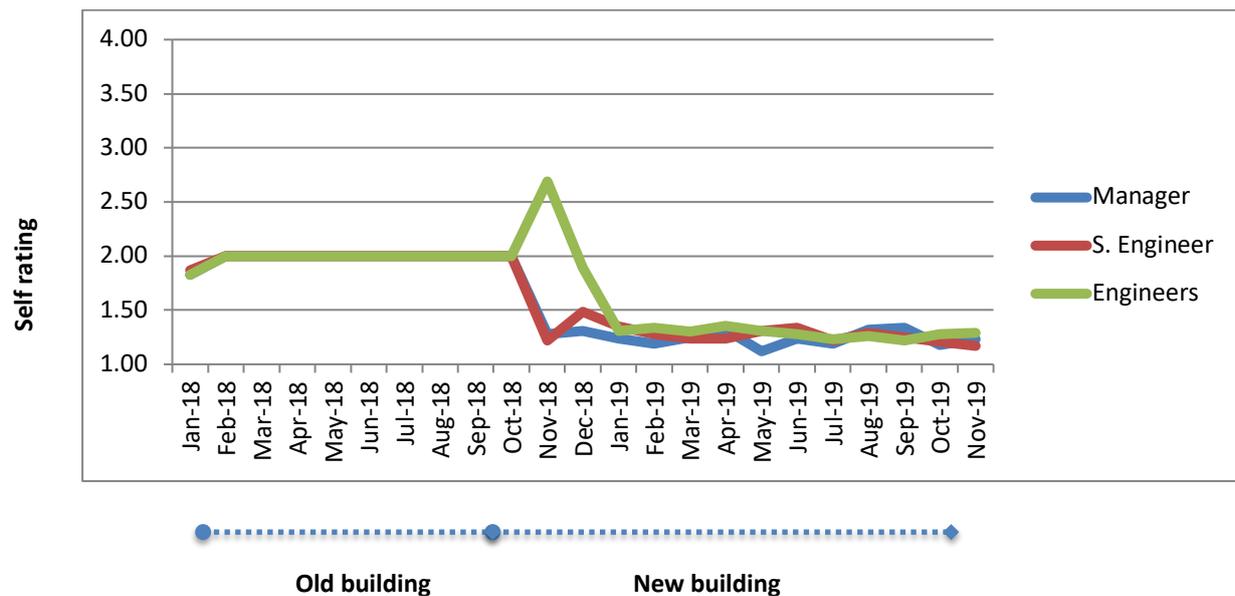
**Figure 4.12: Average Performance Ratings**

Results indicated that in the old built environment, participants engaged in constructive, deliberative and consensus oriented appraisal process. I observed a marginal improvement in ISO compliance ratings and average performance ratings in the new built environment, though there was a constraint in identifying a clear trend. More participants were also recognized for their contribution to bettering ISO processes in the new built environment with ratings of ‘2’. The procedure adopted and findings have been elaborated in Appendix 15.

### 4.7.3.2 People Measures

Further to the insights gained from qualitative findings (see 4.7.1.2.1), self-ratings in the category Mood state (Innate) was plotted to understand changes in employee wellbeing in the old and new built environments as shown below:

**Figure 4.13: Mood state self-ratings**



Results indicated that production department participant mood states were displayed during periods of less work in line with the cyclical nature of project execution intensity. Participants generally used an ad hoc self-rating of ‘2’ to define their mood state in the old built environment. In the new built environment, average self-rating of mood states however indicated an improvement across all positions. Manager and engineer presented an almost immediate improvement in mood state. However, mood state of engineers worsened for about three weeks in the new built environment. The mood state then improved and stabilized to a largely ‘1’ self-rating during the remaining part of the study period. Procedures adopted to understand the findings are explained in Appendix 16.

#### 4.7.4 Conclusion of Developmental study Findings

The new built environment constructed according to the integrated framework proposed in this study seems to have had a positive influence on occupant moods and emotions, productive behaviors, and situation pertinent organization success factors such as process compliance and employee satisfaction. The significance of these findings and recommendations for practice is explained in Chapter 5.

## **5.0 Discussions and Insights**

This section discusses the findings to increase comprehension of the study context and its aims (see 1.1.5). The chapter begins with a summary of the study intentions and then generalizes the study findings related to the research questions.

### **5.1 Summary of the study intentions**

The main objective of this study was to determine the possibility of designing and constructing a built environment that supported organizational success. Literature review on these lines revealed strong indications on the ability of built environments to mold occupant emotions and productive behaviors. Despite advances in the understanding of built environment factors that promoted productivity, there lacked a holistic and complete design understanding to guide practice. Conventional built environment practice followed a deterministic model with key result areas that centered on achieving cost advantages and efficiencies while ignoring parameters that affected human scaling. The impact of built environments on occupant affect is an emerging research frontier and restricted to academic discussions. Contemporary practice thus lacks conceptual models to guide design of built environments for positive affect and productive behaviors. This is contrary to the approach of Eastern architectural practices; a review of which revealed occupant emotional wellbeing as the center of its design philosophy.

This study endeavored to adopt an alternative basis for the design and setting up of a new built environment for the organization under study. Before wholeheartedly venturing into a new design approach, I undertook an intervention study to modify and ‘humanize’ an existing built environment in accordance with suggestions from Eastern vernacular architectural practice. This was done as a pilot study to conserve resources, narrow the field of action and see merit in adopting the ‘humanizing’ philosophies. Besides accumulating knowledge in the field, it was reasoned that benefits if seen in the intervention study will serve to mitigate the risk profile before designing and constructing a new green field built environment.

To contribute to knowledge, care was taken to ensure that the intervention study built environment was selected after an intensive analysis that encompassed practical feasibilities in controlling confounding variables and ability to directly attribute changes if any to the intervention. Thus, the intervention was done in a building that served as the only built

environment to facilitate and support the activities of the training division. Besides possibly supporting the occupants in the training division, it was expected that an exhaustive study would serve to further knowledge that lies at the intersection of built environment, emotions and productivity. It was envisaged that this alternative design mechanism for a built environment might be highly attractive to managers looking for new avenues to gain competitive advantage, or for those vexed with the problem of employee passiveness that seems odd and of unknown reason.

Based on these aims of the study, research questions were framed to provide focus and guide the selection of inquiry methods. To answer the research questions with a rich description of the phenomena, a qualitative mode of inquiry was adopted with a single instrumental case study. Data was generated from an insider perspective at my area of practice through workplace discussions, observations while co-working and participant logs. Data was captured into daily journals, reflected upon and allocated into a monthly reflection report with evolving categories and themes that permitted a further secondary reflection and triangulation across data sources.

This study was expected to make a contribution to the paucity of qualitative and insider studies in the organizational built environment domain. It also aimed to understand the concept of organizational built environment and prevalence of environmental psychology in a context like India (Hemani and Das, 2016), where studies are rare and practice focuses on deterministic attributes as in other parts of the modern world.

Besides attempting to solve the organizational problem, this study similar to the design approach mentioned by Inam (2002), strives to make a meaningful impact (i.e. through improving the quality of life) to organizational built environment design by being teleological (i.e. motivated by purpose rather than explanation of the phenomena through traditional disciplines) and by being catalytic (i.e. driven to positively impacting socio-economic processes). Teleological approach to built environment design involves design initiatives that have an exploratory angle (Inam, 2002), as is the case with this study. This approach allowed leveraging knowledge in different contexts and across geographies to find a solution to the workplace problem. This objective was accomplished through presenting a unified East – West combination framework to assist built environment design.

## 5.2 Discussion on Intervention findings

Research questions were framed in the study (see 1.1.5) to determine impact of the intervention on:

1) Moods and emotions, 2) productive behaviors and 3) success factors

Findings of the study are explained in chapter 4. When the findings were reviewed, I observed that changes occurred across organizational levels with varying intensities, involved multiple variables, and exerted emergent effects individually and in a team. This made presentation difficult and I realized that findings independently did not provide a complete picture of the intervention effects. Therefore, to facilitate concise representation and thorough understanding, I adapted the findings into a system's perspective using a design structure matrix (Browning, 2002).

Qualitative data requires deeper analysis, and presentation of findings through matrices, models, networks and flow charts, promote thinking (Bazeley, 2009). Visual displays summarize, simplify and transform data. They enhance data analysis, help in presenting the findings, relate categories and themes, discuss inferences and enable conclusions (Verdinelli and Scagnoli, 2013). This increase understanding of the phenomena and allows the practical findings to be applied in a manner that will enhance action and impact (Vaismoradi et al., 2016).

Design structure matrix analysis allowed me to connect the codes and categories that evolved from thematic analysis to the IMO (input – mediator – output – input) process framework (Ilgen et al., 2005). Following an intervention study, the IMO framework is well suited to capture emotional and affective changes within individuals and teams, through the additional 'input' provided at the end of the model to facilitate cyclical causal feedback (Ilgen et al., 2005). Therefore, a 3 x 5 matrix was tabulated in which rows showed positions within the organization (Managers, Seniors and Juniors) and columns illustrated affective, behavioral and productivity changes that were depicted through input – mediator – output – input dimensions. Cells of the matrix were then filled with relevant codes and categories that developed from the thematic analysis. The levels of analysis were kept continuous and dynamic to link the categories into a complete picture of the intervention effect on multiple contexts and time frames (Pettigrew et al., 2001). The design structure matrix that evolved from the study findings is shown below (Table 5.1):

**Table 5.1 Design structure matrix – Intervention study**

	Positions	Input	Mediator		Output	Input
		Mood	Emotion	Productive Behaviors	Productivity	Mood
Post-Intervention	Managers	Low Activation Pleasant	Momentary and occasional High Activation Unpleasant state to a sustained Low Activation Pleasant state	Increased	Increased	Low Activation Pleasant
	Seniors	High Activation Pleasant	Low Activation Pleasant	Increased	Increased	High Activation Pleasant
	Juniors	High Activation Pleasant	High Activation Pleasant	Increased	Increased	High Activation Pleasant

Developing the design structure matrix on these lines provided clarity and generated explanation about the research questions as elaborated in the following sections.

## **5.2.1 Influence of the Intervention on moods and emotions**

Based on the findings in the study, this section discusses the impact of the intervention on occupant mood states, on emotional reaction to stimuli within the department and on emotional reaction to stimuli from outside the department.

### **5.2.1.1 Occupant Mood states**

Post humanizing the built environment according to Eastern Architectural practices, study findings demonstrated an improvement in mood states across positions. This was in line with benefits proposed in neuroarchitecture studies (Higuera – Trujillo et al., 2019; Fich et al., 2018; Coburn et al., 2017; Vartanian et al., 2015) and Eastern architectural practices (Kryzanowski, 2015; Xie et al., 2012; Adhikari, 2006; Schweitzer et al., 2004). However, benefits noted across participants were not uniform, as there were differences in the intensity of improvements and timelines for the improvements to take effect post intervention. Mood trajectory of Managers changed from High Activation Unpleasant to Low Activation Pleasant in about 3 weeks post intervention. Mood profile of seniors changed from Low Activation Unpleasant to High Activation Pleasant after about a week post intervention. Juniors saw an almost immediate change from Low Activation Pleasant to High Activation Pleasant post

intervention. This observation was in accordance with scholars of Eastern architectural practices, who suggested that benefits of humanizing the built environment could be seen immediately to a year post the intervention (Krishna, 2001).

Differences in the mood change trajectories noted across positions could be because of participant age group differences. Juniors displayed lesser degree of mood changes in the study similar to an outcome stated by Stanley and Isaacowitz (2011), “young adults were less varied in their trajectory of mood change”. As older adults are more sensitive to stressors compared to younger adults (Mroczek and Almeida, 2004), experience and age factors could also possibly explain the reason for a more negative base affect profile in managers and seniors compared to juniors in the pre intervention scenario. Similarly, juniors displayed a better base affect profile in the pre-intervention period as non-activated affect might have buffered those individuals against the effects of daily stress (Ong et al., 2006). Studies have indicated that the duration of experienced stress is an important factor in mood formation (Mariotti, 2015; Giles et al., 2014). As such, juniors might have also enjoyed a better base affect profile during the pre-intervention phase as they have spent lesser cumulative time in the training division built environment versus the managers and seniors. These contextual and background factors could possibly be a reason for effects of the intervention to be expressed more quickly and positively in the junior group of participants.

### **5.2.1.2 Emotional reactions to unfavorable situations within department**

Study findings revealed that during the pre-intervention phase, managers and seniors exhibited a high activation unpleasant affect profile and juniors exhibited a low activation unpleasant affect profile in response to undesired situations. These unpleasant reactions changed to low activation pleasant reactions during the post intervention period. A calm demeanor was often noted that stabilized into a cooperative and collaborative working sentiment across participants.

Emotional reactions thus treaded the path of positive mood change trajectory that participants experienced during post intervention phase of the study. Benefits of positive mood states were seen to influence the emotional reaction of participants to unfavorable situations within the team environment. This effect observed was in line with earlier studies by Sereno et al., (2015), Scott et al., (2014) and Kampfe et al., (2011) who concluded that positive mood states evoked milder and more favorable affective responses to emotionally charged situations.

Positive mood states have also been shown to improve perception, cognitive states and learning (Tyng et al., 2017; Brand, 2012). This explained observation of pleasant and subtle reactions that enhanced facilitation during situations earlier met with unpleasant affect profiles.

### **5.2.1.3 Emotional reaction to situations outside the department**

Study findings before the intervention pointed to a low activation unpleasant affect profile that was marked by lack of confidence and participant interest during inter-departmental meetings. Post intervention affect changed to a high activation pleasant affect mode with participants seemingly more confident, inspired and articulate during interdepartmental meetings.

These observations were in line with findings from previous literature that noted increased articulation (Mckenna and Lewis, 1994) and improved participant confidence and optimism with positive mood states (Bolte et al., 2003). Nevertheless, it may be argued that High activation pleasant affect participant profile noted during interdepartmental meetings in the post intervention period could also have been caused by increased performance and positive peer feedbacks (Azmat and Iriberry, 2010). However, regular positive feedback from peers in the post intervention period was in turn the result of increased performance that was facilitated by positive participant mood states (Compte and Postlewaite, 2004).

## **5.2.2 Influence of the intervention on productive behaviors**

### **5.2.2.1 Communication**

Study findings indicated that participant communication increased within the department, outside the department and with external stakeholders. Post intervention findings highlighted increased observation of informal chats, greater cordiality and increased Duchenne smiles across study participants. Warm mannerisms and friendly body postures increased approachability, improved listening and enabled better comprehension of situations (Tyagi, 2013). This increased instances of verbal praise and gratitude, and promoted mutual reciprocal interactions as noted in the study. Greater communication and relational links have been shown to increase the quality and completeness of information exchanges during work interactions, streamline work routines and enable participants express frankly through closer

personal relationships (Warkentin and Beranek, 1999). These traits further increased participant engagement with customers and vendors, thus building closer relationships and gathering pertinent business information (Ryssel, 2004). Induced positive mood has been shown to enhance interpersonal communication (Nelson, 2016) through favorable emotion regulation (Rime, 2007). Thus, increased communication noted in this study is most likely a secondary effect of the built environment intervention through positive mood state induction.

### **5.2.2.2 Task execution traits**

Study findings after the intervention indicated that participants accorded better participation and commitment, experienced improved task persistence and self-efficacy and appreciated greater degree of self-rated task attainment at the workplace.

On analyzing the self-rated task attainment, participants recorded an average task completion rate of 78.3% after the intervention, against 55% that was recorded prior to the intervention. The average task completion rate noted after the intervention compared with average global task completion rates of 78% noted in literature (Sauro (2011) in Sauro and Lewis, 2016, p.41). Increase in task attainment followed the positive mood change trajectory that was noted after the intervention. This observation was in accordance with findings in psychology literature that demonstrated increased task performance and pursuit of goal attainment with an induced positive mood state (Cameron et al., 2018; Tsai et al., 2007). Similar to the observations in this study, Baron (1990) demonstrated superior task performance after environmentally inducing positive mood states with pleasant scents.

Closer analysis of the task attainment rates further revealed that during the pre-intervention period, juniors recorded an average task completion rate of 58%, against 52% recorded by seniors and 51% by managers. Similar trends with proportional increases were also noted in the post intervention period with juniors recording an average task completion rate of 82%, against 78% recorded by seniors and 75% recorded by managers. These position based variations in findings are reflective of the better mood levels of juniors compared to seniors and managers, and can be attributed to differential effects of the built environment intervention on participants due to age group differences (see 5.2.1.1).

### **5.2.2.3 Participation and Commitment**

Study findings signified greater participation and commitment amongst participants after the intervention. Increasing number of participants adhered to better work discipline and punctuality, were keen to take up greater work responsibility and attempted proactively at challenging tasks, delivered superior customer service through enhanced involvement and voluntarily spent over time hours to meet work targets. Increased participation and work commitment were also noted with reduced levels of absenteeism (Mowday et al., 2013; Woods et al., 2012; Kinjerski and Skrypnek, 2008) and increased average time spent at work (Kodz et al., 2003; Brown and Roloff, 2011).

Average absenteeism during the study period reduced from about 3 days in a month to less than 1 day in a month. Contrary to custom in the training department wherein all holidays would be utilized, these participants went on to exchange unused holidays for monetary benefits according to company policy. These effects did not have a stabilization period and were noted soon after the intervention suggesting the effect of positive mood creation (Pelled and Xin, 1999) and possible reduction of sick building syndrome symptoms (Joshi, 2008).

Similarly, average time spent at work increased from 7.6 hours per workday to about 8.7 hours per workday. Despite this voluntary increase in average time spent at work, I also observed that working hours spent were less than 48 to 56 hours a week that is generally suggested to maintain a healthy work life balance (Harrington, 1994; Sparks et al., 1997; Fleck et al., 2009). These effects were noted soon after the built environment intervention, suggesting the new work routine to a secondary effect of positive mood creation that increased quality of work and optimized time spent at work (Lesiuk, 2005).

### **5.2.2.4 Task persistence and self-efficacy**

Study findings and observations during co-working suggested higher task persistence and self-efficacy in participants after the built environment intervention. As induced positive mood facilitates cognitive functions (Nusbaum et al., 2018), greater degrees of self-confidence and self-belief displayed while dealing with task challenges is likely due to the positive participant mood states seen after the intervention (Kavanagh, 1987; Baron, 1990; Tsai et al., 2007).

### **5.2.2.5 Decision-making**

Findings after the intervention implied reduced time taken for decision-making, both individually and in meetings. Operational decision-making became firmer and more articulate. Decision-making alternatives were also explored in greater volumes, became creative with more ideas generated, were more effectively reasoned out and organized into an action plan for efficient implementation. Literature has consistently shown the impact of induced positive mood in enabling decision-making process (Mirela, 2018; Lerner et al., 2015; Duque et al., 2013; Bolen, 2007; Lerner et al., 2004; Mayer et al., 1992; Isen and Shalker, 1982). Thus, it is possible that better decision-making abilities noted at the end of the study was a result of positive mood creation facilitated by the built environment intervention.

### **5.2.2.6 Pro-social behaviors**

Study findings indicated an increased prevalence of pro-social behaviors such as backing up behaviors, extra role behaviors, increased sense of team identity and better conflict management conduct after the study intervention. I observed that more participants were willing to help their colleagues through personal difficulties, took up additional responsibilities voluntarily to meet collective team goals, exhibited greater team bonding with increased sentiments of togetherness and mutually resolved conflicts before they became apparent through meaningful discussions. Literature has pointed to the benefits of induced positive mood states in promoting effective team behaviors (Adams and Anantatmula, 2010) such as backing up behaviors (George, 1991), extra role behaviors (Williams and Shiaw, 1999), team identity (Thomas and Hynes, 2007; Tropp et al., 2006; George, 1992) and conflict management behaviors (Desivilya and Yagil, 2005; Bar-Tal et al., 2007; Montes et al., 2012). Thus, it is likely that increased observation of pro social behaviors noted after the built environment intervention was encouraged by positive mood state formation in participants.

### 5.2.3 Success factors

Study findings after the built environment intervention indicated progress in success factors of the training department with better financial measures, superior customer feedbacks, better compliance to operational protocols, improved wellbeing and satisfaction, and more creativity and flexible thinking displayed for future preparation. Positive moods have been shown to have a significant impact on quality of work, productivity and organizational success (Urban and Botez, 2016).

Likewise, during the post intervention study period that suggested a shift towards positive mood profile amongst participants, I noted a steady increase in revenue generation across customer segments. This could be attributed to the increased initiatives from participants, which was a reason for the profitability decline noted for a few months after the intervention. Operation expenses increased due to associated market exploration and new service delivery costs. In this context, it must be made aware that that these new initiatives were completely participant driven and can be explained through increased creativity and idea generation noted after the intervention. Increase in expenditures soon yielded benefits through increased profitability realized through economies of scale as was noted during the remaining part of the study. As financial measures can be a reflection of the sum of employee efforts (Eckerson, 2010), it may be inferred that increased operational efficiencies and higher revenues driven through better participant wellbeing and induced positive mood states played an important role in achieving this (Krekkel et al., 2019; Haddon, 2018). In addition, increased customer satisfaction and enhanced idea generation from participants complimented the uptrends in organizational success parameters (Mauboussin, 2012).

Pre-intervention customer feedbacks were a consistent, '3 – met expectations' across all positions. This can be explained through local customer cultural conditions in Asia that strives to minimize critical feedbacks (Molinsky, 2013). Customers tended to maintain a middle order '3' rating for most work assignments and appreciated superior experiences that exceeded their expectations with positive feedbacks and higher '1', '2' ratings (Wang et al., 2008; Lee et al., 2002; Grandy, 1996). The post intervention period saw an improvement in customer feedbacks across all positions with juniors enjoying better average feedbacks compared to seniors and managers. This variation is possibly due to built environment intervention induced age group differences in positive mood formation (see 5.2.1.1) and corresponding self-efforts to impress the customers. However, towards the end of the study,

feedbacks were not consistently high, though they were better than the pre-intervention figures. This is because perception of service delivery changes with passage of time (O'Neill and Palmer, 2004). A closer analysis revealed that positive feedbacks were more common during new service deliveries and with new customers (Parasuraman et al., 1985). This could be credited to the novelty factor and innovation in service deliveries (Lee and Lee, 2015) with customers, who in turn complimented with better feedbacks (Kraft and Martin, 2001). Executing incrementally superior deliveries take time and might be the reason for plateauing of feedbacks noted with the passage of time (Lee and Lee, 2015). Nevertheless, with greater creativity and flexible thinking influenced through environment induced positive mood (Mitchell and Boyle, 2019; West and Farr, 1990), the average feedback noted at the end of the study was better than at the beginning of the study. At the same time, increased participant attention to future preparation initiatives, resulted in more alliances and associations during the post-intervention period.

#### **5.2.4 Summary of Intervention study discussion**

By using the design structure matrix analysis of findings in an IMOI process framework, it became apparent that changes in the built environment spatial orientations through entrance modification had exerted a positive multidimensional impact across occupant affect, productive behaviors and success factors in the organization. As indicated in literature, positive mood state induced by the environment intervention would have activated productive behaviors that in turn resulted in increased productivity (Baumeister and Bushman, 2014).

A temporal sequence based analysis of study findings in the built environment (Helbich, 2018; Hematalikeikha et al., 2014) also indicated that more positive mood states was followed by more productive behaviors, and more productive behaviors was followed by more positive mood states (Snippe et al., 2018). This showed that built environment induced positive mood states and goal realizations through activated productive behaviors had an additive effect (Gendolla et al., 2007).

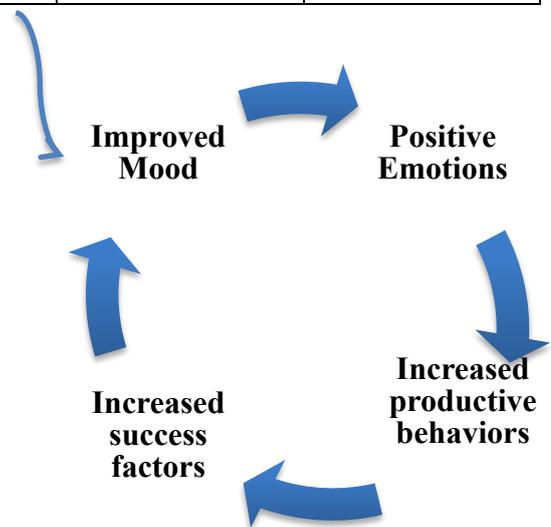
When study findings were simplified into a visual display (Verdinelli and Scagnoli, 2013) to aid understanding, it revealed an affect landscape as indicated in table 5.2 below. As depicted, I noted an improvement in mood states after the built environment intervention, which then improved emotional reaction to situations and thus increased prevalence of productive behaviors at the workplace. Resulting better work culture improved workforce

productivity that in turn further improved participant mood states. These dynamics bettered the social environment of the training department, and resulted in increasing individual and team potential in a virtuous circle (Da Silva, 2018; Selman and Knight, 2006; Seamon, 1984).

Thus, this study confirmed that humanizing the workplace built environment through Eastern architectural design concepts yielded benefits for occupants and the organization.

**Table 5.2: Summary of the Intervention study discussion**

Position	Pre-Intervention		Intervention	Post-Intervention	
	Mood state	Emotional reaction		Mood state	Emotional reaction
Managers	High Activation Unpleasant	High Activation Unpleasant		Low Activation Pleasant	Low Activation Pleasant
Seniors	Low Activation Unpleasant	High Activation Unpleasant		High Activation Pleasant	Low Activation Pleasant
Juniors	Low Activation Pleasant	Low Activation Unpleasant		High Activation Pleasant	High Activation Pleasant



## 5.3 Discussion on Developmental study Findings

As in the intervention study and with a similar scientific rationale, IMOJ framework was used to capture participant affective changes in the new built environment (see section 5.2). Design structure matrix that evolved from the study findings is shown below (Table 5.3) and generated explanations on study findings have been illustrated in the following sections.

**Table 5.3 Design structure matrix – Developmental study**

	Positions	Input	Mediator		Output	Input
		Mood	Emotion	Productive Behaviors	Productivity	Mood
New Built Environment	Manager	High Activation Pleasant	Occasional, brief and momentary low activation affect during times of unfavorable situations to a sustained high activation pleasant	Increased	Increased	High Activation Pleasant
	S. Engineer	High Activation Pleasant		Increased	Increased	High Activation Pleasant
	Engineers	High Activation Pleasant	High Activation Pleasant	Increased	Increased	High Activation Pleasant

### 5.3.1 Occupant Mood states

In the new built environment that was designed and constructed in accordance with the integrated design framework proposed in this study, study findings demonstrated an improvement in mood states across positions.

The affect profile of manager, senior engineer and engineers shifted from a low activation pleasant to a high activation pleasant state. Manager and senior engineer saw an almost immediate improvement in mood states in the new built environment that then persisted during the remaining part of the study period. However, engineers saw their affect profiles deteriorate to neutral and Low activation unpleasant states during the initial 3 weeks in the new built environment, before stabilizing to a high activation pleasant state noted during

remaining part of the study period.

Pleasant base affect profile that existed in the old production built environment can possibly be attributed to all participants being in a generational age group of 25 to 35 years and absence of any generational tension – with no younger employees managing older ones (Knight, 2014). Old production built environment design layout could also have played a key role in the positive base affect profile noted in occupants, as its analysis against the integrated framework revealed better design compliance with concepts of Eastern architectural design versus the training built environment that predicted better harmony, energy and wellbeing amongst participants (see 5.4).

Initial mood profile deterioration of engineers in the new built environment could have been because of the perception of geographic distance from co-workers (Leonardi et al., 2010) that impedes interpersonal bonds and informal workplace friendships (Kiesler and Cummings, 2002), restricts proximity to sources of task related information (Wellman et al., 1996) and impacts everyday work routines (Putnam and Mumby, 2013, p.363). On the other hand, it is conceivable that immediate mood profile improvement in supervisors could have been inspired by work redesign (Hackman, 1980), while applying their regular managerial duties in the pleasant new workplace atmosphere that supported better mood (Clements-Croome, 2015; Fitzgerald and Danner, 2012; Spies et al., 1997). Therefore, by reasoning the immediate post occupation observations, it is possible that longer term positive mood state creation noted in participants during the remaining part of the study was facilitated by the new built environment design as elaborated in section 5.2.1.1.

### **5.3.2 Emotional reaction to challenging situations within department**

In the new built environment, emotional reaction intensity to challenging situations changed from Low activated unpleasant affect profile to High Activated pleasant affect profile in Manager and Senior Engineer. Engineers similarly experienced a positive change from neutral and low activated affect profile to high-activated pleasant affect profile in the new built environment, though there was an initial dip to a low activation unpleasant affect profile. Just as in the intervention study, emotional intensity to unfavorable situations followed the positive mood change trajectory noted in the new built environment. As the study is based on comparable settings and scientific rationales, explanations to reason the positive emotional changes noted are mentioned in the corresponding discussion section

under intervention study (see 5.2.1.2).

### **5.3.3 Influence on productive behaviors in new built environment**

#### **5.3.3.1 Workload coping ability**

Study findings indicated that participant workload coping ability improved in the new workplace built environment. Findings highlighted reduction in workload perception with improved multitasking attributes, improved ongoing performance and broader attention focus amongst participants.

Workload and quantum of work to be executed within a given time period is frequently mentioned as a stressor in the workplace (Li et al., 2017; Li and Lambert, 2008). Induced positive affect has been shown to foster hope and create mechanisms to deal with workplace stress through thought patterns that facilitate flexible, integrative and creative dispositions (Isen, 1999). It also stimulates openness to information processing and broadens administering of relevant information (Reed and Aspinwall, 1998). Once coping processes are in position, they have in turn shown to sustain and generate positive affect (Khosla, 2006).

As was seen in the study findings, induced positive emotions have been shown to increase the ability to multitask (Morgan and D'Mello, 2013), when different tasks were combined at the same time and were often used as a means to cope with the workload (Woods et al., 2018). Participants also benefited from enhanced pro-social behaviors (see 5.2.2.6) and interpersonal conflict management (Leiter, 1991; Dix, 2017) as peer support plays a pivotal role in reducing workload perception (Lacey et al., 2007). In addition, induced positive mood also facilitated increased attention levels and broader participant focus (Martin and Kerns, 2011), thereby eliminating work routine redundancies noted in the study findings. These effects as noted in the study findings consequently suggested to the secondary effect of positive mood creation in the new built environment.

#### **5.3.3.2 Preparation Time**

Study findings in the new built environment pointed to quicker task preparation and reduced time requirement. Findings revealed traits of increased participant confidence and willingness to take risks, supporting reduced task preparation time.

While compiling the effects of environmentally induced moods and emotions on cognitive flexibility, Hsieh and Lin (2019) presented the possibility that induced emotions could have influenced preparation time. Similarly, Fredrickson (2001) while commenting on the role of emotions, reasoned that positive emotions undo preparation time for specific action, while negative emotions create a hold on person's mind and make individuals continue task preparation though they were already prepared (Hsieh and Lin, 2019). In line with the study findings, Yuen and Lee (2003) observed that people in induced positive mood states were willing to take greater risk. Thus, it is likely that positive mood state facilitated by the new built environment, reduced preparation time noted in the study findings.

### **5.3.3.3 Creativity**

Study findings indicated increased participant creativity in the new built environment. Findings revealed increased participant use of shortcuts to increase work efficiency, better task organization through associations and greater cognitive abilities while finding solutions.

These findings noted were in agreement with prior studies on the benefits of induced positive mood states. Positive mood states tend to promote heuristic techniques with increased reliance on mental shortcuts (Baron and Branscombe, 2009), use of truncated processing strategies to increase efficiencies and better categorization in task organization (Martin and Clore, 2013). Environmentally induced positive mood also increases the ability to consider unusual associations and aspects of the situation to generate novel solutions in circumstances where conventional strategies fail (Andrade and May, 2004). In addition, induced positive mood increases creativity by increasing association among cognitive elements, by increasing breadth of cognitive elements relevant to the problem and by enhancing cognitive flexibility to think about numerous concepts concurrently (Chermahini and Hommel, 2012). Participant creativity improvements could thus be the secondary effect of positive mood profile enabled by the new built environment.

### **5.3.3.4 Pro – social behaviors**

Study findings shed insights on increased pro – social participant behaviors such as informal knowledge sharing, backing up behaviors and transition from a blaming behavior outlook to joint collaborative effort in dealing with difficult situations.

These observations are in line with literature opinions that induced positive mood reduced the tendency to engage in blaming behaviors (Goldenberg and Forgas, 2012) and increased knowledge sharing in groups (Barnard and Pendock, 2013; Tenorio et al., 2017). These aspects therefore denote the underlying effect of positive mood creation in the new built environment.

### **5.3.4 Success Factors Discussion**

Study findings in the new built environment indicated improvements in success factors concerning process and people measures.

Financial measures and market measures were not applicable in this study as the production department was not an independent stand-alone unit but a link in the larger chain of departments that together contributed to organization success. As there was no independent P&L account maintained by the organization for the production department, it was not possible to measure success in revenue generation. Since the production unit catered to an intermediate step within the larger production process, there was no customer feedback that was solely applicable for their respective efforts. Similarly, future preparation measures were outside the scope of responsibilities of participants in the new built environment. Hence process measures and people measures were the only success factors that could be attributed to participants in the new built environment.

People measures and wellbeing states improved in the new built environment, and this could conceivably be attributed to positive mood state creation as explained earlier (see 5.3.1 and 5.2.3). However, process measures showed a marginal increase in the new built environment. This could possibly be because of pre-existing reasonable performance level in the old built environment. Therefore, it is plausible that mood improvements in the new built environment did not immensely improve process measures because of performance threshold effects at the workplace (Vischer, 2007) and limiting effects of the intervention in an induced mood - performance landscape (Penetar et al., 1994; McLellan et al., 2016).

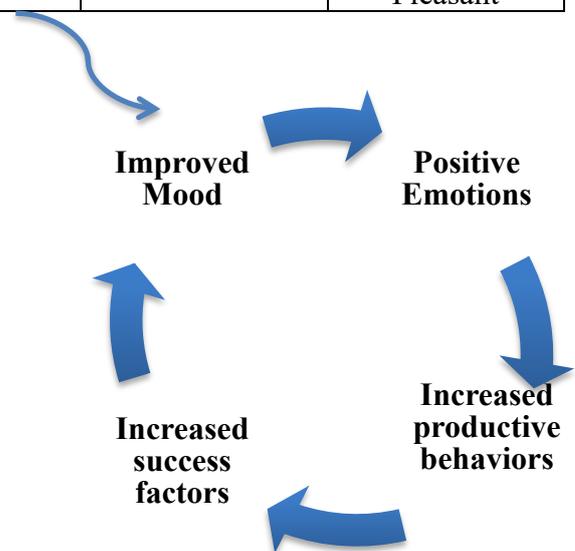
### 5.3.5 Conclusion of Developmental study discussion

The new built environment designed in accordance with the integrated design model proposed in this thesis positively influenced occupant moods, emotions and productive behaviors at the workplace.

Similar to the intervention study discussion conclusion (see 5.2.4) and with a comparable logical basis, it is likely that benefits noted were driven by a built environment induced positive affect landscape that activated productive behaviors, which in turn resulted in increased success factors within the new built environment. These dynamics further reinforced each other in a virtuous circle, contributing to a better social landscape in the new built environment as shown in the visual display (see table 5.4 below). Thus, this study indicated that applying Integrated design model in the workplace built environment generated positive benefits for occupants and the organization.

**Table 5.4 Summary of the Developmental study discussion**

Position	Old Built Environment		Integrated Design Framework	New Built Environment	
	Mood state	Emotional reaction		Mood state	Emotional reaction
Manager	Low Activation Pleasant	Low Activation Unpleasant		High Activation Pleasant	High Activation Pleasant
S. Engineer	Low Activation Pleasant	Low Activation Unpleasant		High Activation Pleasant	High Activation Pleasant
Engineers	Low Activation Pleasant	Low Activation Unpleasant		High Activation Pleasant	High Activation Pleasant



## **5.4 Comparison between Intervention (Study 1) and Developmental (Study 2) findings**

To facilitate evidence-based interpretation and empower critical analysis of the study findings, the discussion section should broadly summarize the principal study implications for a logical synthesis of the results (Annesley, 2010). Both the intervention and developmental study improved affect states, productive behaviors and productivity in occupants. Despite the advantages noted, there were differences in the benefit intensity and characteristics of productive behaviors noted between the two studies.

Intervention study saw considerable improvements from the prevailing pre-intervention affect states. Improvements noted in the developmental study group was not as substantial; however, this must be understood within the context that prevailing affect states in the pre-developmental production participant group were more pleasant than in the pre-intervention training department.

To understand the possible role that built environment design has in this observation, compliance of pre-intervention training built environment and old production built environment to the integrated design framework was determined (see Table 5.5). This evaluation concurred with opinion of the consultant that the old production built environment was more compliant to the Eastern architectural concepts, thereby resulting in better affect profiles displayed by occupants in the old production environment. As the pre-existing main entrance in the old production built environment was inadvertently positioned in the neutral energy zone, compliance of this built environment was better than the training built environment that had its entrance in the negative south east energy zone. Despite other design deficiencies, position of the entrance in a neutral zone bestowed the old production built environment with relatively favorable mood attributes according to Eastern architectural concepts (see 2.6.2.2).

Summary of the transition to positive affect state has been depicted (see Table 5.6) to illustrate the differences in mood and emotional improvements between the developmental study and intervention study after adopting Eastern Architectural concepts. The intervention study, wherein the training built environment underwent change in position of entrance as the only subject of intervention, increased confidence in applicability of humanization principles in the study context. The subsequent developmental study undertook a holistic approach of

incorporating the design principles into developing a new built environment, resulting in positive mood and emotional shifts in participants.

The intervention study was a controlled study and served the study purpose with its structure of an independent revenue generating department within the organization, and all of its activities and employees housed in the same built environment. I also had profound work related operational engagement with the training department unlike the production department where I had a dominant supervisory role. This allowed me to engage and work with employees in the training department on a real time basis and enabled collecting a rich source of data. This explains the variation in characteristics of productive behaviors noted between the intervention study and development study built environments (Table 5.7). Unlike the intervention study, there was also no variation in the levels of certain behavior characteristics such as absenteeism and duration of time spent at work between the old and new production built environments. This indicated good participation and some virtuous work related behaviors in the old built environment that perhaps was a reflection of positive environment induced mood states that pre-existed in the old built environment prior to the developmental study.

In addition, unlike the independent nature of training department in the intervention study, participants in the new production built environment contributed to a chain of inter-related activities that together produced the final products. As such all organization success factors were not applicable in the developmental study context (see Table 5.8).

**Table 5.5 Applying Integrated Design Framework to the pre-intervention factory and training built environments**

Discipline	Built Environment Factors	Suggested Guidelines	Existing Factory built environment (Developmental Study)	Compliance in Existing Factory built environment	Existing Training built Environment (Intervention Study)	Compliance in Existing Training Built Environment
Environmental Psychology	Light	Use light without flicker and glare with an illumination of about 400 lux suitable for a task at hand.	Well-lit through artificial flicker free electric lighting. Specific areas require greater illumination provided with focus lights.	Yes	Electric flicker free lighting was provided for illumination with focus lights for specific areas.	Yes
	Noise	Limit noise to 85 dB by using sound absorbing materials and equipment with low noise emission.	Maximum noise emission was limited to 75 dB by using sound absorbing materials and equipment with low noise emission.	Yes	Maximum noise emission was limited to 60 dB by using sound absorbing materials and equipment with low noise emission.	Yes
	Temperature	Arrest upper temperature limit to 30 °C with air movement in a warm and humid climate.	Maximum indoor temperature restricted to 28 °C with cooling towers and ventilation systems.	Yes	Maximum indoor temperature restricted to 24 °C with cooling and HVAC systems.	Yes
	Ventilation	Ensure proper ventilation with air movement.	Proper ventilation maintained through roof based ventilation ducts, mist fans, air purifiers and need based air conditioning.	Yes	Proper ventilation maintained through air conditioning.	Yes
	Furniture	Worktables and their spaces should be ergonomically designed	Worktables and their spaces are ergonomically designed.	Yes	Worktables and their spaces are ergonomically designed.	Yes
	Space	Avoid high people density and cramped equipment in the work areas.	Individuals and other equipment are well spaced out to avoid crowding.	Yes	Individuals and other equipment are well spaced out to avoid crowding.	Yes
	Control	Maximize individual control over built environment elements.	Individual control of light, airflow, equipment, Noise emission.	Yes	Individual control of light, airflow, equipment, Noise emission.	Yes

	Natural Daylight	Increase natural light through windows and skylight if available.	Well-lit production floor through artificial electric lighting. Daylight complemented electric lighting.	Partly	Well-lit work areas through artificial electric lighting and complemented through several windows.	Partly
	Indoor plants	Position indoor plants	No Indoor plants.	No	No indoor plants	No
	Smell and fragrances	Avoid sources of bad odor near working areas.	No bad odor near working areas with their emission sources situated far away.	Yes	No bad odor near working areas with their emission sources situated far away.	Yes
	Color	Lighter colors and shades of white, blue and green	Lighter colored interiors; shades of white and green.	Yes	Lighter colored interiors; shades of white and green.	Yes
Humanizing the Built Environment	Shape	Square or rectangular	Irregular shaped building.	No	Rectangular shaped.	Yes
	Position of Entrances	Main entrance – position in Northeast Secondary entrances – position in the zone of exalted energies	Main entrance is positioned in a North west neutral energy zone. Secondary entrances are positioned according to convenience	Partly	Main entrance is positioned in Southeast negative energy zone and Secondary entrance in neutral energy zone.	No
	Weight Distribution	Position heavy equipment in the South, West and heaviest equipment in Southwest. The North and East directions should be positioned with lighter equipment.	Equipment's are positioned on an ad hoc, ease of access and convenience basis. This approach resulted in heavy equipment being positioned in the North and East sides.	No	Laboratory equipment positioned according to convenience and on an ad hoc basis, resulting in their positioning across all directions.	No
	Spatial arrangement	Position heat emitting sources in the South East quadrant, water emitting sources in the Northeast and finished goods dispatch from the Northwest quadrant.	Utilities and equipment were positioned to optimize costs and increase convenience. Consequently, Generators and heat sources were in the North East, water generating sources and underground water tanks in the North West and goods storage was in the Southwest.	No	Utilities and equipment were positioned to optimize costs and increase convenience. Heat emitting sources were positioned in the North and water generating sources in the West direction.	No

**Table 5.6 Comparison of the transition to positive affect state in the intervention and developmental study**

<b>Noted changes</b>	<b>Participants</b>	<b>Pre-Intervention Affect</b>	<b>Post Intervention Affect</b>	<b>Participants</b>	<b>Pre-Developmental Affect</b>	<b>Post Developmental Affect</b>
<b>Mood</b>	Managers	High Activation Unpleasant	Low Activation Pleasant	Manager	Low Activation Pleasant	High Activation Pleasant
	Seniors	Low Activation Unpleasant	High Activation Pleasant	Senior Engineer		
	Juniors	Low Activation Pleasant	High Activation Pleasant	Engineers	Low Activation Pleasant	Initial Neutral and Low Activation Unpleasant to High Activation Pleasant
<b>Emotions within the Department</b>	Managers	High Activation Unpleasant	Momentary High Activation Unpleasant to	Manager	Low Activation Unpleasant	High Activation Pleasant
			Sustained Low Activation Pleasant			Occasional and brief Low Activation to
	Seniors	High Activation Unpleasant	Low Activation Pleasant	Senior Engineer		High Activation Pleasant
	Juniors	Low Activation Unpleasant		Engineers		Low Activated, Neutral
<b>Emotions outside the Department</b>	All participants	Low Activation Unpleasant	High Activation Pleasant	Not Noted		

**Table 5.7 Comparison of productive behaviors between intervention and developmental study**

<b>Benefits</b>	<b>Intervention Study</b>		<b>Developmental Study</b>	
<b>Productive behaviors</b>	<b>Traits noted</b>	<b>Post effect</b>	<b>Traits noted</b>	<b>Post effect</b>
Communication	Departmental communication, inter-departmental communication and communication with external stakeholders	Increased	Not noted	
Task Execution	Self-rated goal attainment, participation and commitment, and self-efficacy and task persistence	Increased	Workload coping capability, preparation time	Increased
Decision Making	Decision making time and Alternative generation	Increased	Not noted	
Pro-social Behaviors	Backing up behaviors, extra role behaviors and Team identity	Increased	Backing up behaviors	Increased

**Table 5.8 Comparison of success factors between intervention and developmental study**

<b>Benefits</b>	<b>Intervention Study</b>		<b>Developmental Study</b>	
<b>Success Factors</b>	<b>Measures noted</b>	<b>Post effect</b>	<b>Measures noted</b>	<b>Post effect</b>
Financial measures	Monthly orders in hand, profitability	Increased	Not applicable	
Customer/market measures	Customer feedback for participants	Improved	Not applicable for participants	
Process measures	ISO compliance ratings, average performance ratings	Increased	ISO compliance ratings, average performance ratings	Marginal improvement
People measures	Employee satisfaction and well-being indicated through self-ratings in the mood state category	Improved	Employee satisfaction and well-being indicated through self-ratings in the mood state category	Improved
Future preparation measures	Indicators for alliances, partnerships and memorandum of understandings	Increased	Not applicable	

## 5.5 Summary of the study discussion and its significance

Contemporary built environment design practices have limited knowledge and focus in influencing favourable occupant affect and wellbeing. To address the dearth of affect-based ecological models in contemporary built environment design, this study reviewed Eastern architectural sciences that revealed achieving harmony and positive occupant affect as the focus of its design approach. Based on literature indications, I reasoned that the prescriptive holistic approach in Eastern architectural design principles could positively influence occupant wellbeing at the workplace.

To implement the solution, I organized the study into two parts – Initially a pre-post intervention pilot study based on suggestions from Eastern literature was applied to the existing training built environment. This pilot study was carried out to evaluate benefits of applying Eastern architectural practices and to mitigate organizational risk before venturing into a new built environment construction based on alternative design approaches. Subsequently, a pre-post developmental study based on an integrated framework with concepts from environmental psychology and Eastern architectural literature was applied to construct a new manufacturing facility for positive occupant affect.

To evaluate the implementation benefits, research objectives were framed to understand effects of the intervention on: 1) Moods and Emotions, 2) Productive Behaviors and 3) Organization success factors. Pre-post occupant landscape was tracked through an insider ethnographic approach.

Post-intervention study results indicated – 1) shift in occupant moods and emotions to a pleasant affective profile, 2) increased Productive behaviors, and 3) improved organization success factors.

### **1) Shift in moods and emotions**

Participant mood states became more pleasant in both the post-intervention and post-developmental studies. In the **Intervention study**, innate mood profile of – managers changed from High Activation Unpleasant to Low Activation Pleasant in about 3 weeks post intervention; seniors changed from Low Activation Unpleasant to High Activation Pleasant after about a week post intervention; and Juniors saw an almost immediate post-intervention change from Low Activation Pleasant to High Activation Pleasant state.

In the **Developmental study**, innate mood profile of participants shifted from low activation

pleasant to high activation pleasant state in the new manufacturing built environment. Managers and senior engineers saw an almost immediate improvement. However, engineers saw their mood profiles deteriorate initially to low activation unpleasant states, before shifting to a high activation pleasant state after about 3 weeks. Initial deterioration in mood states was likely due to perception of geographic distance from co-workers in the newly constructed built environment.

Thus, between the Intervention and Developmental studies, and within the respective study, participants experienced varying intensities in mood change trajectories and different timelines for the effect to take place. This observation was in accordance with Eastern architectural literature. Disparity noted across positions could be because of participant age group differences, variation in work responsibilities, tolerance to on-going stress, and distinction in accumulated negative affect based on length of prior exposure in the pre-intervention built environment.

In addition, pleasant moods pre-existed in the old manufacturing built environment compared to the pre-intervention training built environment. This observation was likely because of the old manufacturing built environment's better design compliance with Eastern architectural design concepts that predicted better harmony and wellbeing amongst participants. Difference between built environment contexts could thus be another reason for the more pronounced benefits noted in the post-intervention training built environment, compared to the new manufacturing built environment.

Similar to the positive changes observed in the mood states, post intervention participant emotional reactions displayed milder, optimistic and more favourable affective responses to emotionally charged situations. This observation was due to the benefits of induced positive mood states in moulding agreeable emotions.

## **2) Increase in productive behaviors**

**Post-intervention** training built environment participants displayed increased participant communication, better task execution traits, improved decision-making attributes and pro-social behaviors. Similarly, participants in the **post-developmental** new manufacturing built environment exhibited better workload coping ability, reduced preparation time, increased creativity and enhanced pro-social behaviors.

Differences in productive behaviors noted between intervention and developmental studies

were likely because of dissimilarities in the nature of researcher's work engagement between the training and manufacturing organization departments. Nevertheless, increased prevalence of productive behaviors observed was likely through favourable emotion regulation; a secondary effect of the built environment intervention induced positive mood state creation.

### **3) Improved Success factors**

**Post-intervention study** noted superior – financial measures, customer feedbacks, process measures, participant wellbeing, and future preparation measures. However, profitability declined initially due to increased participant led exploration expenses, before showing an upward trajectory. Similarly, high initial customer feedbacks noted after the intervention stabilized to better than pre-intervention states, possibly due to changes in perception of service deliveries with passage of time.

**Post-developmental study** indicated marginal improvements in process and people measures. Degree of improvement was less significant than in training building possibly because of better pre-existing outcomes and resulting performance threshold effects at the workplace. Also, other success factors were not applicable since the manufacturing department was not an independent stand-alone unit, unlike the training department.

### **Sense making of the findings**

Both studies maintained positive changes for more than a year post the intervention, showing benefits from a workplace built environment context. Design structure matrix analysis of findings indicated that the built environment intervention contributed to positive participant mood states, which then served as an input to improved emotional reaction at the workplace. Better emotions resulted in increased prevalence of productive behaviors at the workplace that then served as a mediator to increase workplace productivity and success output. Improved productivity further improved participant mood states in a virtuous circle. These dynamics bettered the social workplace environment, and indicated that humanizing the workplace built environment through Eastern architectural design concepts yielded benefits for occupants and the organization. Furthermore, the integrated design model applied in the developmental study, addressed the need for a holistic affect-based ecological model in contemporary workplace built environment design.

## **6.0 Conclusion Chapter**

This section elaborates on the study contributions and suggestions for practitioners to enhance interpretations of similar situations in a different context, study limitations and suggestions for furthering the knowledge generated. The chapter then concludes with an exploration of the study impact and change in perspectives to my professional practice.

### **6.1 Suggestions to contemporary action knowledge praxis**

This section elaborates my understandings from the study findings and its discussions. Despite being a single case study at my organization, these understandings may enable other practitioners design and develop workplace built environments in similar settings, provide solutions to seemingly mundane workplace problems, improve wellbeing and productivity, and use it as a means to gain competitive advantage. These elaborations complement the thick study description presented in this thesis and enhance study dependability (see 3.1.5.3).

#### **6.1.1 Built environment as an approach to enhance organizational wellness**

The study showed that the workplace built environment had the ability to transform occupant mood states, stimulate formation of productive behaviors and improve workplace productivity. Of particular interest to me was the observation that information sharing on targets, competitors, evolving technologies and tools to succeed became commonplace and led to automatic empowerment (Yukl and Becker, 2006) without any structural changes in business processes. I noted cooperative human architectures taking shape within the social system and greater management of daily operations through management by exception (Dekker and Woods, 1999; Willis et al., 2017). As George (2000) suggested that moods and emotions play a pivotal role in leadership and management process, it is likely that the changes noted in operational management was due to positive mood creation with the built environment modification.

Humanizing Workplace built environments should thus be considered as a means to improve organizational wellness (Jack and Brewis, 2005) and be an integral part of management concepts that visualize the organization as a living organism affected by their environments (Morgan, 2011). Study observations support the proposition that built environment induced positive mood states would have increased humorous interactions (Gervais and Wilson,

2005), appreciative inquiry (Coghlan, 2019) and modified team dynamics (Janz et al., 1997) that would have increased the prevalence of productive behaviors at the workplace.

This approach is in contrast to the conventional single-minded focus on cost efficiency, functional utility and resource conservation exercised by organizations and practitioners during the lifecycle of building projects (Akadiri et al., 2012). Wellbeing, health and mood properties are not a priority in built environment design today due to the difficulty in associating financial advantages with the built environment (Alker et al., 2014). Despite evidence of the impact of built environment on mood and behavior, Alker et al., (2014) suggests that pre and post intervention studies in real world settings are needed to evoke practitioner interest. With observed practical benefits and a rich description of the procedures adopted, this study can inform decision making and lead to better acceptance by practitioners.

### **6.1.2 Benefits of humanizing with Eastern architectural practices**

Discoveries within biology, psychology, anthropology, neurosciences and related sciences have potential to improve the quality of built environments, and restructure emotions and cognitive abilities through new scientific architectural design models focused on occupant wellbeing (Mallgrave, 2013). Notwithstanding this research driven design aspiration for ‘humanizing’ a built environment, concept of space has rarely been examined in detail (Bates, 2018). Humanization of built environments has been shown to improve emotional wellbeing. However, further studies are needed to deepen our understanding of their role in health, human – nature relationship and to develop guidelines for practice (Totaforti, 2018). Despite limited knowledge in modern practice, Eastern architectural practices are however designed to create humanized (human centered) spaces that inspire wellbeing and harmonize with nature by harnessing natural forces with spatial orientations (Craven, 2003; Ellis, 2005; Malathouni, 2013).

With limited practical guidelines on humanizing a built environment that have been experimentally verified with a real project (Pellitteri and Belvedere, 2011), this study has shown the benefits of leveraging traditional architectural concepts in humanizing the built environment. The study findings can serve as sufficient reason for practitioners to explore beyond the trend of internationalized style of modern built environment architecture that often ignores accumulated knowledge of the past (Serghides, 2010), developed intuitively through valid concepts (Fathy, 1986).

### **6.1.3 Integrated model for humanizing the built environment**

As built environments affect wellbeing through multiple pathways (Northridge et al., 2003), Lo et al., (2003) suggested the need for integration approaches to humanize built environments. To illuminate professional practice and bridge the research – practice gap (Avenier and Bartunek, 2010), a dialogical model (Avenier and Cajaiba, 2012) was derived from the study findings and discussions to advance a logic for humanized workplace built environment design. To contribute to practice, a methodological framework appears to be more enlightening (Parmentier Cajaiba, 2010). However, built environment studies are complex and often linked to numerous disciplines (Tougwa, 2016; Cairns, 2008; Vischer, 2008; Raftery et al., 1997). This requires a multidisciplinary approach and qualitative methods serve as suitable tools to understand such complex phenomena (Jabareen, 2009). This complexity makes generation of a framework difficult, though frameworks are outputs of qualitative processes (Jabareen, 2009).

Accordingly, incorporation of Eastern architectural concepts to built environment design model was done after benefits were established through the thematic analysis of the intervention study and discussions with IMO framework. My reflections on these lines provided insights on the study outcomes. However, in the modern built environment domain, environmental psychology and environment behavior studies are growing and have progressed to partly impact moods and behavior of people at workplaces and leisure settings (Moser and Uzzell, 2003; Nasar, 2015; Wells et al., 2016; Kopec, 2018). Incorporating these emerging concepts within a framework is useful as each concept plays an integral role in such a construct (Jabareen, 2009). To reflect the emerging trends, I also used literature sources to gather environmental psychology factors that have been shown to positively affect occupants in built environments.

Consequently, the study process and extant literature was synthesized to create a model for humanizing built environment design (see Table 3.17). I believe that this model can guide practice in similar settings through depiction and interplay of different factors in the built environment. To generate knowledge, Avenier (2009) suggests activating knowledge by putting the model into practical use in various settings. To meet this criterion, the developmental study was based on the integrated model developed during this study. These measures adopted in the study together with confirmation of benefits seen through the developmental study can thus increase practitioner relevance.

## **6.2 Study Contributions to literature and practice**

### **6.2.1 Contributions to Research**

This dissertation presents a comprehensive, multi-disciplinary review of relevant built environment literature that relates its impact on human affect and resulting productivity at the workplace. By reviewing literature mentioned in this thesis, gaps in humanizing the built environment for positive affect and business performance were identified. New avenues were subsequently presented through a combination of Western and Eastern built environment design knowledge. Thereafter by implementing the new design method through an intervention study and subsequent developmental study, the research initiative led to significant contributions to the organization.

The process adopted and resulting successful outcomes, pointed to several literature contributions:

- This study expands knowledge on the effect of the built environment design in influencing human affect, ensuing productive behaviors and organizational success. Prior environment behavior research has primarily focused on human aspect of the built environment, versus this research that also explores firm level outcomes through research approaches that have not been done previously.
- This work moves beyond focusing on one specific factor and reconciles heterogeneous factors in the built environment through an integrated model. It explores the nature of these factors and their ambient conditions that support human performance. Although existing studies recognize the capability of individual built environment factors to influence human affect, I take design inspiration from Eastern architectural practices that adopt a prescriptive rule based approach to holistic built environment design.
- Usefulness of the research is evident by the exhaustive wide approach to studying and applying built environment factors through the developmental study. Applying built environment research in an organization is an important secondary contribution; a key contribution to research is the approach taken to exploring this complex environment and its various factors that exert influence on the human affect.
- This study builds on the list of environmental factors that influence human affect by focusing on an underexplored dimension of spatial orientation through the

intervention study, and subsequently applying multiple factors holistically through an integrated model proposed in this thesis and implemented through the developmental study.

This study thus made contributions to literature by:

### **1) Understanding human experience in a real-life built environment and its impact on affect and organizational productivity**

Holistic analysis in this study added to the body of existing knowledge by confirming results of previous environment behaviour studies that emphasized importance of built environment characteristics in influencing occupant affect. Further, this insider qualitative study generated a rich description of the mood altering and resulting behavioral transformation effects on occupants by modifying workspace built environment. As qualitative studies play a key role in understanding phenomenon and theory generation, several scholars have argued for its need in the built environment context (e.g., Chan et al., 2007; Vischer 2007; Heaton 2016). Study findings thus make a significant contribution to the need for qualitative studies in built environment, environmental psychology and environment – behavior literature and contribute to the paucity of built environment studies in a real world setting (e.g., Ashkanasy et al., 2014; Alker et al., 2014; Hall et al., 2017).

By adopting a multi-disciplinary approach to draw together a fragmented and dispersed literature (McLellan, 2017; Lawrence, 1983), the study addresses the theory deficit and relevance to practice that is widely acknowledged in the environment and behavior research field (Zube and Moore, 2013).

Although research design and study methodology for understanding psychological interactions between people and built environment are less known (Du Toit and Mouton, 2013); the study explored contextual human factors through a longitudinal, ethnographic account in a case study format to map occupant affect and productive behaviors. By observing study participants in their natural workplace environment and with periodic participant interactions, study methods adopted did not rely solely on use of self-reports that is the dominant method of collecting participant data in built environment behaviour studies (Bower et al., 2019). This study thus overcomes the limitation of self-reports in affect evaluation (Schwarz, 2007) and makes a rich contribution by trending detailed participant behaviours in response to the built environment. This study can be contrasted with the vast

majority of built environment studies that use an initiating stressor to artificially induce prevailing negative participant affect profiles prior to determining benefits of the built environment (Beil and Hanes, 2013). Moreover, by extending the data analysis to organization outcomes, the study included firm level analysis beyond the impact on individual affect and productivity noted in extant literature. This study thus linked together research methodologies that to the best of my awareness have not yet been applied to the built environment research context. The study approach adopted could also provide real world insights for researchers as they embark on workplace built environment research. In addition, this study also reaffirmed the widely cited benefits of positive mood states at the workplace in reinforcing positive productive behaviors and inducing superior task execution traits (e.g., Tsai et al., 2007; Nusbaum et al., 2018). Against built environment studies in a simulated setting that are not wholly adequate in capturing reality, this study design in a real-life setting contributes to literature by drawing meaningful inferences through a rigorous understanding of human experience in the workplace built environment (Karakas and Yildiz, 2020).

## **2) Emphasizing built environment spatial parameters**

Designing built environments in the right way is one of the most fundamental questions facing research (Shemesh et al., 2017), despite considerable literature pointing to the benefits of optimizing environmental parameters in the built environment such as ambient light, acoustics, temperature and stability (Hensen and Lamberts, 2012). Besides these factors, this study highlighted the importance of space in humanizing built environments for positive occupant psychological benefit. Although, increasing evidence from research on spaces indicates its ability to exert and mould physiological and emotional experiences on occupants (Barrett and Bar, 2009; Eberhard, 2009; Bar and Neta, 2007), modern knowledge on the subject is evolving and has largely remained in research realms at the intersection of several disciplines – neuroscience, cognitive psychology, architecture and environment-behavior studies. Though research on the subject has shown good potential; less advanced methods of user behavior evaluation, difficulties in determining the way occupants feel and obstacles in measuring human affective responses to built spaces have constrained research progress to computer simulation of human behavior in built environment contexts (Simeone and Kalay, 2012). Therefore, spatial design parameter has limited significance in mainstream built environment sciences with people still relying on designer's experience with form, user and

function (Shemesh et al., 2017).

On the other hand, Eastern architectural concepts have a codified prescriptive approach to spatial design in the built environment. By moulding space in the study built environments through position of entrances, building shape, positioning of building elements and spatial weight distribution based on Eastern architectural principles; this research effort resulted in occupant and organizational benefits. The study thus contributed to literature by highlighting an alternative route to attaining occupant benefit in the built environment through spatial orientation of building constituents.

### **3) Presenting Eastern design concepts as a field for mainstream built environment research enquiry**

Learning from vernacular literature and applying a hybrid approach to modern architecture can be a solution to solving existing built environment design problems (Almatawa et al., 2012). Concepts in vernacular architecture have promoted sustainability in built environment design (Creang et al., 2010) and integrating such concepts into existing buildings and modern architectural designs have yielded occupant benefits (Nguyen et al., 2019). Traditional systems of practice handed down through generations are a rich source of knowledge on the environment (Iaccarino, 2003; Mazzocchi, 2006) and can be used in understanding adaptive human responses to environmental triggers (Berkes et al., 2000).

By qualifying an Eastern architectural concept of spatial orientation through intervention study in this thesis, the research contributes to literature by potentially evoking interest in the millennial old Eastern architectural practices. Furthermore, hybrid integration model actualized through the developmental study, contributes to research by presenting a realistic approach for complementing traditional knowledge with modern sciences, despite their variations in definition terms and mode of descriptions.

### **4) Devising a unified East-West built environment design basis with multiple environmental factors for positive affect**

Despite increasing research attention on design aspects that evoke positive human behavior in the built environment (Lawrence and Low, 1990; Benton et al., 2016; Kobal Grum, 2018), there is still no unified framework that balances design elements and reflects the multidimensional concepts for designing a built environment for people (Sime, 1985; Reddy

at al., 2012; McLellan, 2017). Furthermore, research in this field has siloed and expanded in isolation, limiting impact at an organization level (Brown et al., 2005). Built environments are however complex systems and need an integrated multifactorial framework that reconciles heterogenous factors in the built environment into a unified model for meaningful impact at an organization level (Williams, 2013; Dasgupta, 2018).

By collating spatial design parameters and environmental psychology factors from Eastern and Western literature respectively, and applying it in a real world setting with pre and post analysis, this study presented a design elements analysis process to investigate built environment characteristics that influence occupant affect. Further, through combining built environment factors across environment behavior studies and Eastern architectural sciences into an integrated design model implemented in the developmental study, an attempt was made to provide an affect based design framework. The proposed model is also flexible and scalable to incorporate new design parameters that influence wellbeing; making it useful for researchers (Moffatt and Kohler, 2008). Findings and discussion in this applied study further enhance the understanding of built environment design characteristics that support occupant wellbeing.

## **5) Contributing to the modern Indian Built environment literature.**

Study provides understanding on the contemporary Indian built environment context where humanizing and sustainability concepts are unclear, rare and ignored (Hemani and Das, 2016; Puthucode Sivaraman, 2017). This study thus contributes to the workplace built environment literature by illustrating a real-world case study in modern India.

## **6.2.2 Contributions to practice: Practical Implications**

The study made contributions with practical implications through:

### **1) Chronicles of Employee behaviors in the workplace built environment**

Design structure matrix analysis (see Table 5.1 and 5.3) can provide practitioners and managers with awareness of subtle differences in sensitivities and sentiments, across age groups and levels of seniority at the workplace.

### **2) Highlighting importance of built environment at the workplace**

With a widespread prevalent notion that built environments have a mere support function and needs to be cost optimized (Kim and Kang, 2016; Petri et al., 2017; Xue et al., 2018), the study results can persuade practitioners to explore built environments as another focus area to drive competitive advantage. Study may also be interesting to practitioners who are keen on having a well-functioning workforce (Jungert et al., 2018). This study can inspire them to consider the health of their built environments as a means to enhancing autonomous work motivation that is essential for organizational success (Jungert et al., 2018).

### **3) Representation of an integrated design model for the built environment**

The humanized built environment design model proposed in this study together with suggestions and insights from finding discussions can provide a humanization checklist and conceptual map for practitioners while they venture into built environment creation or modification to satisfy business needs. Knowledge presented in this model when combined with emerging trends in built environment research will enable practitioners design a built environment for employee wellbeing and organizational success. Much like Birkeland's (2012) proposition in his book on built environment, the complementary integrated design model suggested in this study has the potential to increase wellbeing, inspire quality of life and enthuse all round positive development in a virtuous cycle.

## **6.3 Study Limitations**

Study limitations are those characteristics that influenced interpretation of findings, constrained generalizability, and reduced study applications to practice (Lebaree, 2009; Price et al., 2004). Outlining the study limitations is important for placing the research findings in context, interpreting validity and ascribing credibility to the conclusions (Ioannidis, 2007).

### **6.3.1 Researcher reflection on study findings and discussion**

While this study demonstrated the advantages of an affect based built environment design model based on Eastern architectural practices in influencing affect, behaviors and organization success factors at the workplace; study benefits were determined through a quasi-experimental pre-post intervention study design (Jhangiani et al., 2015), with no participants randomly assigned into conditions or a control group. This makes it likely that despite the best efforts to control all confounding variables in the built environment,

researcher cannot be certain that no other workplace factors influenced the causal relationship. Better post intervention data as noted in this study, cannot conclude with a high degree of certainty that the intervention was responsible for the improvement noted. It is possible that between the pre and post intervention environment, events outside the realm of study controls might have happened or participant characteristics might have changed. This becomes important when dealing with attitudes and behaviors, which involves psychological considerations that the participants themselves may not be aware of.

This limitation must however be viewed within the context of this real world workplace setting, where random assignment is difficult within a blinded study design that is required to maintain research rigor. Environment behavior studies often use quasi-experimental study designs as they can be applied in the real world and can include variables that are tough to mimic in laboratory studies (Abrahamse et al., 2016). Associations in quasi-experiments meet some degree of causality as intervention precedes observation of the outcome (Eliopoulos et al., 2004). However, internal validity or causal control in quasi-experimental research is lower than true experiments but generally higher than correlational studies. Moreover in this study, positive benefits were also noted in both the post intervention studies that were conducted at two different parts of the organization; lending support to a higher degree of certainty that the implemented solution was responsible for the improvement noted.

This study endeavoured to design a solution for the workplace situation and then evaluated the effectiveness of the implemented solution at the workplace setting. Therefore, the purpose of this study is not to prove causality but to assist the studied organization, and to further the body of knowledge in what embodies design that is beneficial to built environment occupants.

This section further provides an overview of the study limitations as indicated below.

### **1) Study limited to one organization**

Study findings are based on a single case study in an organization with manufacturing and training service lines. This constrains generalizability of the study results to other industries and organizations. However, this is not considered as a significant limitation as focusing on one organization allowed for the research to generate rich data.

### **2) Number of study participants**

This research was conducted with 23 participants which, according to De Ruyter and Scholl (1998) is a reasonable sample size but according to other authors (Perry, 2000; Carson et al., 2001) a modest size for qualitative research. Although sample size in this study supported rich data generation, depth of analysis and was adequate for the study at hand (Sandelowski, 1996), qualitative sample sizes are often characterized as insufficient without justification and often included in study limitations due to perception of constraints in generalizability of such study results in nomothetic terms (Vasileiou et al., 2018).

Further, Patton (2002, p.244) stated, “there are no rules for sample size in qualitative enquiry” and emphasized, “ sample size depends on what you want to know, the purpose of the inquiry, what’s at stake, what will be useful, what will have credibility, and what can be done with available time and resources”. With inclusion of the entire affected population in the study, the sample size consequently is representative, comprehensive and complies with Patton’s sample size tests of resource availability, usefulness and credibility (Patton, 2002).

This potential limitation is thus considered to be not significant as the research scope consisted of one organization with the entire staff of the training department during the intervention study (14 members), and total staff to be relocated to the new built environment of the production department during the developmental study (9 members).

### **3) Controlling confounding variables**

Gebel et al., (2015) suggests controlled evaluation of interventions and people’s behaviors to provide highest level of evidence in the built environment research field. Despite exercising precautions to control confounding variables in the study, built environment studies have reported practical difficulties in controlling them (Benton et al., 2016). Observational study designs have constant challenges in ensuring validity and completeness of confounding variables (Norgaard et al., 2017). Due to continual and high level of interactions between people and their built environments and given the number of variables, study designs may not capture all the confounding factors (National Research Council, 2006, p.4)

Thus, although the study used a proven research design with pre/post study format (Moore et al., 2018; Benton, 2016; Audrey and Batista – Ferrer, 2015) that included the entire population, it is possible that all mediating factors were not recognized in the study design to evaluate direct impact of the intervention. Although the study allowed me to identify the different factors, inputs and processes in the built environment that influence affect states, the

ability of different factors to influence each other was not determined in the study due to scant literature on relation between these factors in the built environment.

#### **4) Limitations with the Developmental study**

Knowledge generated through the intervention study was integrated into a built environment design model that was then implemented at the manufacturing division through the developmental study in a green field facility. Implementing the model with multiple parameters in the green field facility allowed for the holistic effect of the intervention to be noted versus the pre developmental study. However, it can be argued that the better alternative would have been to test the model in the same existing built environment with renovation as a mediator to implement the model rather than constructing a new green field facility.

This was a conscious decision and should be viewed within the context of business needs, practicalities and organizational flexibilities. Though a direct comparison of pre-developmental and post-developmental studies will not be possible due to changed circumstances from the pre-developmental built environment, this study will meet the objective of determining benefits of integrated design model by virtue of having same participants as study subjects in both studies and continuation of earlier research protocols.

#### **5) Constant participant mix during study period**

The study did not experience employee turnover and study participants remained the same throughout the study. This can be attributed to two factors. First, in the intervention study, training team members were long time members of the organization. Second, in the developmental study, production team members selected to move to the new facility were core team members with good experience of working at the organization. While the static nature of the participant pool was helpful in attributing effect to the intervention, this study could not evaluate the effect of newcomers or changes in team composition that is common in a typical work setting and have been shown to affect mood states (Kelly and Barsade, 2001; Volmer, 2012).

#### **6) Insider nature of the study and my position**

Data quality could have been affected by my lived experience in the organization, pre-understanding (Coghlan, 2019) and my position as CEO in the organization. Though I could

avoid the stage of establishing workplace relationships and ensure faster implementation, my position could have limited my access to informal communication, genuine thoughts and feelings of people through power distance (Kwantes et al., 2018). I also possessed complete autonomy in the organization that complimented my ability to facilitate and control the research process. This convenience may not be available for an outsider or insider at lower levels embarking on research. Under such scenarios it is likely that the organization management might question the need for built environment transformation that will then disturb the dynamics of the research process.

### **7) Individual personality differences of participants**

Individual personality differences such as degrees of extraversion, agreeableness and neuroticism have been shown to affect self-evaluations of daily activities (Komulainen et al., 2014). This was not factored into the study design. Therefore, the degree of built environment effect or its influence on different personality categories was not known through the study. This potential limitation is not considered to be significant as study design included daily interactions with participants.

### **8) Possible effects of emotional contagion**

It is possible that benefits with built environment modification seen across participants could have been amplified and moderated by emotional contagion (Schoenewolf, 1990; Elfenbein, 2014), the effects of which could not be quarantined in the study design. This potential limitation is not considered significant as there was no change in participants and individual affect changes of participants were monitored closely.

### **9) Limitations on the use of self-reports**

Despite the dominance and widespread use of self-reports for collecting data in behavioral and social sciences (Schwarz, 2007), measuring engagement through self-reports are sometimes ambiguous and problematic as an index for affect intensity (Gendolla et al., 2007). This potential limitation is not considered to be significant because of data confirmation through triangulation.

## **6.4 Future research suggestions**

A good research inevitably unwraps new questions. To demonstrate research credentials, a good thesis should outline conceivable future research directions for continuing the described line of enquiry (Ruger, 2016). Future studies should address study limitations noted in this study using research designs that better support the multifaceted relationship between built environment and wellbeing (Gillis and Gatersleben, 2015; Schulz et al., 2016).

### **6.4.1 Thoughts on improving the intervention study design**

To confirm study causality that the intervention was responsible for the improvement noted, an experimental study design with participants randomly assigned into a control group and separate intervention group would have yielded stronger internal validity. However, due to the difficulties in participant randomization in a realworld workplace built environment intervention setting, quasi-experimental studies are commonly used (Abrahamse et al., 2016). Where situations permit, and uniform study controls are exercisable, a more robust design would have been one that combines elements of a nonequivalent design (where participants are not randomly assigned to conditions) with pre-post intervention design (Jhangiani et al., 2015). When this format is applied to the organization built environment, there will be an intervention group that receives a pre-intervention analysis, intervention at the built environment that houses them and post-intervention analysis. At the same time, there will be a control group in another built environment within the same organization compound that receives pre-intervention analysis, no intervention at the built environment that houses them and post-intervention analysis. In such a scenario, the researcher can determine whether participants in the intervention group improved more than participants in the control group. Although such a design will improve causal validity, it will still not completely eliminate possibility of confounding variables. But if participants in this design are randomly assigned, it will become an experimental study setting and result in greater internal validity.

This section provides further insights into areas that would benefit from future research:

#### **1) Moderating factors and their role in the built environment**

The integrated design framework developed in this thesis (Table 3.17) provides a reasonable account of variables in the built environment that exert a positive psychological impact on occupants, but is not all encompassing. Further studies can understand the salience of

individual parameters, percentage contributions of each factor to positive affect states and investigate relations between built environment factors in the built environment.

Generating a conditional matrix (Creswell and Poth, 2017; Scott and Howell, 2008) to contextualize built environment factors and exploring relationship amongst them vis-à-vis affect and behavior, can provide further insights and testable propositions in the built environment. As such studies are still rare, exploring such analysis can contribute to better understanding of the impact of built environment factors on emotional health and wellbeing (Gillis and Gatersleben, 2015).

## **2) Explanation of how spatial dimensions affect human emotions**

As understanding of the relation between dimensions of space and human emotions are nascent and ambiguous (Shemesh et. al, 2015), mechanism of how spatial orientation in vernacular architecture exerted benefits are beyond the scope of this study but can serve to frame explanatory propositions in future studies.

## **3) Design adapted to stimulate psychological states for task execution**

Certain task profiles such as those that require high performance standards (Gendolla et al., 2007), certain abilities (Spicer and Cederstrom, 2015), accountants and those involved in information processing generated more pertinent explanations in a negative mood state (Cianci and Bierstaker, 2009). As better mood states have sometimes reduced productivity in certain tasks (Coviello et al., 2017), alignment of moods with job profile requirements need to be determined in the workplace built environment behavior context.

## **4) Gender based differences in influence of built environments**

The study results did not observe a difference in affective intensity between male and female participants after the built environment modification. Baron (1990) however noted gender based differences and increase in male self-efficacy after environmentally inducing positive affect. A larger sample size could have ascertained the gender specific variations in affect intensity and can be an avenue for future research.

## **5) Do built environments have a limiting factor in influencing mood states**

Though task attainment in the current study increased to global averages with improved affect states, it needs to be studied if mood states and built environments have a limiting

factor in its ability to influence productive behaviors.

## **6) Analyzing affect using technology**

Video analytics can now be used to analyze occupant affective attitudes and emotions in the built environment (Kaklauskas et al., 2019). In built analytics can be used to broaden the scope of future research across several geographies, industries and contexts.

## **6.5 Conclusion – Final reflections**

Final reflections briefly summarizes and forms an important part of the thesis as it enables readers capture gist of the study context (Feak and Swales, 2011), and helps them understand relevance of the research after they finish reading (Bunton, 2005)

In this thesis, I developed knowledge associated with the research questions through literature review, study findings and discussion, and fulfilled the study aims. This enquiry enabled me to develop suggestions for action that will benefit practitioners who – embark on organizational built environment development especially in an Indian context, seek ways to instill competitive advantage, attempts at gaining insights into employee psychology evolution at the workplace and are keen on exploring ways to improve employee wellbeing and affective dimensions. As envisaged, the study achieved pertinent practical results in developing a workplace built environment that contributed to organizational success and improved employee wellbeing.

Although improvements in productivity maintained for over a year as in this study can show significant benefit from the built environment context (Singh et al., 2010), limitations in study design make conclusions to inform policy challenging. Future research efforts with a consistent approach to measure outcomes can support this endeavor. While this study yielded benefits for the organization within the scope that it intended, positive findings in turn reinforced the merit of several emergent research directions such as neuro-architecture, environmental psychology, environment behavior studies, eastern architectural philosophies and holistic user driven systems design approach. Undertaking this study using scholarly practitioner approach also transformed me into an individual less skeptical of traditional routines and open to the reasoning of accumulated knowledge presented as institutionalized practices. In addition, this dissertation also investigated the positive impact of built environment on affect landscape, productive behaviors and success factors of employee occupants that allowed for a more complex and richer trait analysis than previously seen in literature.

## **Appendix – 1: Research Ethics**

**Warwick Business School**

**Doctoral Programme**

### **Research Ethics Form and Checklist**

The School is committed to ensuring that the research conducted by its staff and students maintains the highest possible standards of integrity and respects the dignity, rights, safety and well-being of participants. This is why it has put in place procedures for considering the ethical aspects of all proposals for research.

Research students in their first year of registration must complete this form, in consultation with their supervisors, and submit it via *my.wbs* as part of their Upgrade review documentation. Importantly however, this should be seen as a living document. In particular, should your study change in any substantial way following this initial submission (e.g. change in participants, or methods, or a new experiment/research question, or similar), you **must** submit an updated form before starting your research. If you are not clear whether this is necessary, please contact the DPO or the Nominated Ethics Representative. Doing so is not only an ethical obligation toward your participants, but also requirement by the University. **Completion of this form is mandatory for all WBS doctoral students.**

**Student name:** Vibin B Joseph

**Supervisor (s):** Nicos Nicolaou and Chris Beer

**Title of proposed research project:** DBA – Emotions of the workplace built environment: The forgotten “success” variable?

### **SECTION 1: HISTORY OF APPROVAL**

**Is this your first Research Ethics Form submission?** YES

**If the answer to the above is NO, please tell us in brief about when previous approval was given, by whom, and how this application differs?**

### **SECTION 2: DECLARATION**

(A) I confirm that I have read and understand the following documents:

1. The University’s Research Code of Practice:  
[http://www2.warwick.ac.uk/services/rss/researchgovernance/research\\_code\\_of\\_practice/](http://www2.warwick.ac.uk/services/rss/researchgovernance/research_code_of_practice/)
2. The Economic and Social Research Council’s *Research Ethics Framework*:  
<http://www.esrc.ac.uk/funding/guidance-for-applicants/research-ethics/>
3. The University’s Humanities and Social Sciences Research Committee’s (HSSREC) Guidelines for Research Students: [Research Ethics Form February 2017 - PhD.docx](http://www2.warwick.ac.uk/services/ris/research_integrity/researchethicscommittees/hssrec/student/)[http://www2.warwick.ac.uk/services/ris/research\\_integrity/researchethicscommittees/hssrec/student/](http://www2.warwick.ac.uk/services/ris/research_integrity/researchethicscommittees/hssrec/student/)

(B) I confirm that I (in consultation with my supervisors) have considered the ethical implications of the proposed research project and that it is consistent with the principles outlined in the above documents.

(C) I confirm that the research project does involve direct interaction with human participants or their data, and that I have completed Sections 2-4 of this form as accurately as possible as a result.

### **SECTION 3: RESEARCH ETHICS CHECKLIST**

Please answer each question by ticking the appropriate box

	YES	NO
1. Will the research involve NHS patients or their data, NHS staff, premises or facilities?		X
2. Will the research involve audit and evaluation of projects involving NHS patients or their data, NHS staff, premises or facilities?		X
3. Does the research involve participants who are vulnerable or unable to give informed consent (e.g. children or young people, those with learning disabilities or cognitive impairment, or individuals in a dependent or unequal relationship)?		X
4. Does the research involve discussion of sensitive topics (e.g. participants' sexual, political or illegal behaviour, their gender or ethnicity, their experience of drug use, their experience of violence, abuse or exploitation)?		X
5. Does the research require the permission or co-operation of a gatekeeper for initial access to the participants (e.g. members of particular ethnic or cultural groups, members of self-help or other interest groups and associations)?		X
6. Does the research involve deception or covert observation of participants without their full and informed consent?		X
7. Does the research require access to identifiable individuals?		X
8. Does the research require access to records of personal or confidential information, including genetic or other biological information?		X
9. Will blood or tissue samples be required from participants?		X
10. Will the research involve any intrusive interventions (e.g. administration of drugs, placebos or other substances, vigorous physical exercise, or techniques such as hypnotherapy)?		X
11. Is the research likely to induce physical pain, psychological stress, anxiety or humiliation or cause more than minimal discomfort?		X
12. Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?		X
13. Is the research likely to entail any risk to your personal security and safety as a researcher?		X
14. Is the research likely to pose any risk to the environment?		X
15. Have you obtained the appropriate permissions to carry out this research (e.g. to obtain data, access to sites etc.)?	X	
16. Have you taken measures to ensure confidentiality, privacy and data protection where appropriate?		X

## **SECTION 4: PROJECT DETAILS**

<p>Project summary <i>(please describe the nature and aims of the study in brief)</i></p>	<p>The objective of the project is to build a workplace environment for success. Increasing evidence highlights the impact of the built environment on human behaviour and business outcomes. While modern contemporary design methodologies focus on the functional and mechanistic aspects within the built environment, vernacular architecture focus more on making environments conducive to human wellbeing. By making changes in the existing building and constructing a new one designed for success by incorporating advances in modern understanding and vernacular architecture literature, I wish to determine the possibility of using workplace built environment as a means to gain competitive advantage. This will be determined by evaluating changes in workplace behaviour, team emotions (general dispositions), productivity measures and financial results post intervention.</p>
<p>Proposed methods</p>	<p>Observation, Face to face interview and company archival data.</p>
<p>Criteria for selecting participants</p>	<p>The study will be in two parts.</p> <ol style="list-style-type: none"> <li>1) Intervention study: Here the spatial configuration of the existing building for the particular division will be modified based on indications from vernacular architectural literature. People who are working in this building will be part of the study. A pre and post intervention study will determine changes if any after the intervention.</li> <li>2) Developmental study: Here a new green field facility will be constructed based on modern workplace suggestions and vernacular architecture literature. Some employees working in the current facility will be shifted to the new facility as soon as it becomes operational. Post occupation study with them will analyse benefits if any.</li> </ol>
<p>Method for recruiting participants</p>	<p>People employed in the company where the study will be undertaken. Only interested participants will be part of the study.</p>
<p>Number of participants required</p>	<p>About 30 relevant employees of the organization.</p>
<p>Project start and end dates</p>	<p>March 2018 to December 2019</p>

Where will data and consent forms be stored?	Data collected from interviews and observations will be securely stored using passwords and encryption. Hard copy forms will be stored in a secured cabinet at my home office.
How will you ensure confidentiality and anonymity? <i>Please provide a detailed statement.</i>	The study reports will not have names of the participants. Analysis will be done on the combined data. All participants will be kept anonymous by assigning a coded identifier that will ensure subsequent traceability only through the attributed code.

**SECTION 5: RESEARCH ETHICS STATEMENT**

Please summarise the ethical issues that arise from your proposed research **and** how you plan to address these. It is in your interest to make this **as detailed as possible** (e.g. adapting the section on research ethics from your proposal/thesis for these purposes is fine). The summary should be sufficiently developed for the NER to make an informed judgment as part of research ethics approval.

Please also append a copy (including updated copy, if applicable) of the Participant Information and Informed Consent Forms you intend to use (a template for each can be downloaded from my.wbs and adapted, if appropriate, for your project).

This study is about understanding the impact of the built environment on wellbeing of the inhabitants in the workplace. As such I see minimal possibility for any adverse effects on the researcher or study participants. I also do not anticipate any ethical issues that may arise as a result of my interactions with the participants. Participation in the study will be voluntary and participants will be given assurance that their participation will in no way affect their profession or ongoing relationship with the researcher. Participants in the study are educated and prior to interviews, they will sign WBS consent form. Confidentiality will be maintained by me as the researcher and by the participants who will be reminded of their duties to maintain confidentiality of the interactions. Due care will also be exercised in maintaining and storing the research data.

**Please return this completed form to the DPO.**

## **Appendix – 2: Participant consent and Information form**

Title of Project: WBS DBA Research Project

Name of Researcher: Vibin Joseph

Name of Lead Supervisor: Nicos Nicolaou

1. I confirm I have read and understand the information sheet dated for the above study. I have had the opportunity to consider the information, ask questions of a member of the research team and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.
3. I understand that that my information will be held and processed for the following purposes: [completion of the research and, where relevant, for the writing of associated academic journal articles or monographs'].
4. I agree to take part in the above named study and I am willing to be part of the discussions and be interviewed.

---

Name of participant

Date

Signature

Vibin Joseph

---

Name of Researcher

Date

Signature

You are invited to act as research participant for the above project. Your participation in this project is entirely voluntary. You may withdraw from participating in this project at any time, with no negative consequence to yourself or the organisation for which you work.

This is a research project to understand well being in our organization.

The project involves you taking part in research discussions, interviews and your consent to have your interactions interpreted by me.

Your involvement in this project will help provide data for this study.

Participation in this project will involve being interviewed by the above named researcher on the above theme.

It is not expected that you will experience any risks through participating in this project. Data will be anonymised from the start, with no names or specific positions recorded as part of the interview material. Your consent form will be stored in a locked office at the University of Warwick, and transcripts of interview data will be anonymised before being printed and stored in the same place. The transcripts will also be stored electronically on the lead researcher's password-locked laptop. All material may be destroyed after 10 years from the completion of the research. The material from this research may be published. You can request a copy of the publication from the researcher named above.

Should you have any further questions about this research, please contact Vibin Joseph or supervisor Nicos Nicolaou.

You may also contact the University of Warwick Research and Impact Services, University House, University of Warwick, Coventry, CV4 8UW, UK (phone: 02476575732) should you have wish to make a complaint about the conduct of the researcher.

## Appendix – 3: Participant Daily Log

### Participant Daily Dairy to understand well being in our Organization

Towards understanding the well being in our organization, it is important to appreciate your feelings, emotions and moods at the time of reporting. Please follow the instructions below to help you determine your feelings and levels of happiness:

- 1) Take a minute and be self aware of how you are feeling
- 2) If possible, attribute a cause for that feeling
- 3) Point out when the feelings changed for the good or for the bad
- 4) At that moment, rate your sense of well being in the scale below:

- 1) Feeling very good
- 2) Feeling good
- 3) Feeling bad
- 4) Feeling Very bad

As a bare minimum, please record your sense of well being at 9 AM and 5: 30 PM or before you leave office every working day. The more times you fill or as many times as your mood changes, the better it will be.

Also describe the reasons for your stated feelings in the format below. Remember feelings are complex and do not over think! Write down what you feel at the moment. That is all!

**Note:**

As we strive to build our organization on the foundation of well being, I request you to be forthcoming and frank in your thoughts. This is a journey that has the potential to help our family and our organization. Be assured, that nothing stated in this document will be shared or linked with any individual. This is my promise. As social animals, I fully recognize that feelings are complex, and that negative and positive outlook on circumstances and individuals are natural. This will not be taken personally or as means to judge individuals. The provided data will be handled and processed by me directly. I will protect the integrity, impartiality and my fiduciary duty to you at all times.

SD/-  
VJ

Date	Time	Feeling (as 1,2,3,4)	Description
------	------	-------------------------	-------------

## Appendix – 4: Participant Identifiers and Meeting Schedules

### Training Division

Sl. No	Participant Name	Employee ID	Identifier	Gender	Age	Meetings	Observations During
1			J	Male		A,B,C,D	Meetings, routine work
2			K	Female		B,C,D	Meetings, routine work
3			L	Female		B,C,D	Meetings, routine work
4			M	Male		C,D	Meetings, routine work
5			N	Female		C,D	Meetings, routine work
6			O	Male		C,D	Meetings, routine work
7			P	Male		C,D	Meetings, routine work
8			Q	Male		C,D	Meetings, routine work
9			R	Male		C,D	Meetings, routine work
10			S	Female		C,D	Meetings, routine work
11			T	Female		C,D	Meetings, routine work
12			U	Male		C,D	Meetings, routine work
13			V	Female		C,D	Meetings, routine work
14			W	Female		C,D	Meetings, routine work

Meetings	
A	Leadership meeting
B	HOD Meeting
C	Training Division meeting
D	Employee Outreach meeting
<p><b>Note:</b> The meeting identifiers are only for easy grouping, for my reference and serve no other purpose</p>	

### Production Division

1			A	Male		D	Center visits, Outreach meetings
2			B	Male		D	Center visits, Outreach meetings
3			C	Male		D	Center visits, Outreach meetings
4			D	Male		D	Center visits, Outreach meetings
5			E	Male		D	Center visits, Outreach meetings
6			F	Male		D	Center visits, Outreach meetings
7			G	Male		D	Center visits, Outreach meetings
8			H	Male		D	Center visits, Outreach meetings
9			I	Male		D	Center visits, Outreach meetings

### Day wise Meeting Schedules

Participant Identifier	Day
A, B, C, D	Monday
E, F, G, H	Tuesday
I, M, N, O	Wednesday
P, Q, R, S	Thursday
T, U, V, W	Friday
J, K, L	Saturday

## **Appendix 5: Researcher Daily Journal**

**22 January 2018    Monday**

### Team meeting

The HOD meeting started with a reflection of the New year commitments and the monthly progress to date. 5S implementation was the core subject discussed. The HODs were positive and eager to identify new investments for better placing the components and files in the workplace.

At this I voiced, “Have we sorted everything in the first place?” The group had positive sentiments with smiles and eagerly worked towards planning the sorting protocols. The training department was largely silent. Upon prodding for views they made no comments of significance.

### Reflections on training participants

- Lack of involvement, motivation and self efficacy
- No smiles observed

### Participant Observations at work

#### 1) Training building

Today I spent half an hour going around the training building. I noticed that the laboratory wares were not cleaned and the work areas not tidied. The timetable plan for work to be executed was not the most lucid. When questioned about the lack of cleanliness, the manager replied, “I am doing everything to make these people understand “. I said ok and moved on.

#### 2) Production Center

I spent about half an hour going around the facility. A machine was under repair. Upon enquiring, “Maintenance people did not do their job” was the answer. I replied, “I need the work to be completed on time. You guys decide”

### Reflections on participants

- Lack of motivation, planning, task persistence and ownership despite delegated responsibilities
- No smiles observed from participants

### Participant diary discussion

I spent about 20 minutes each separately with A, B, C, D participants from the production department at different intervals during the day and recounted feeling states since the 17th January 2018.

I reflected on their self reporting and nudged them to share more details. Most production participants felt good and happy as “I saw a new interesting avenue” On Thursday 8 January 2018, C finished more work than “I set for myself and was happy”. On 19 January, most of them came to work with a positive attitude as in their words “Tomorrow is a holiday and I want to finish most of the work I have and have a good weekend.” That sentiment changed to ok for most of them barring D, who completed his work by coming in early. On 22 Jan 2018, most of them were not the most positive as a result of the faulty machine.

They all pinned the blame on maintenance team and none highlighted their work style as a possible cause. B found a “smarter way of working“, left early and felt contented. Upon

enquiring, “ if the smarter way of working was shared with someone else” he said, “I don’t feel like telling them but if you tell me I will do it” My upset demeanor in the production center sensitized certain individuals who responded by putting 3 and 4 in their diaries. Upon enquiring, one stated, “ I felt miserable that certain people don’t do their job and felt horrible about myself”.

Reflections on participants

- No helping mentality noted, averse to problem solving, lack of initiative and ownership for task completion

**23 January 2018    Tuesday**

Team meeting

The Training meeting started with the team voicing concerns on the previous day’s consensus for 5S implementation. “ Should we delay the 5 S implementation?” I replied, “ What are the reasons? Is it a sentiment shared by everybody?” “We will not have time with the work in hand” was their reply. I further enquired, “ What work that you are doing is time consuming?” There was silence in the group. When I enquired one by one, they argued with each other on the pending works and timelines. At this I said, “ Lets break for tea”. Upon reassembling I suggested, “ Think of ideas in which you can create impact and be the super smart people that you are. ”

Reflections on training participants

- Lack of coordination, willingness to support each other, lack of good team communication
- No smiles observed

Participant Observations at work

1) Training building

Today I spent about three hours in the training building and participated as usual in some experiments for an on going project. I noticed a lack of focus, determination to complete in a pre decided time plan and agitation amongst several team members. There were squabbles like “ I gave it to you. Why cant you return it“ “Be decent” “Just complete the work” “I don’t care”.

Reflections on participants

- Sense of agitation and irritation
- No smiles observed from participants

Participant diary discussion

I spent about 20 minutes each separately with E, F, G, H participants from the production department at different intervals during the day and recounted feeling states since the 17th January 2018.

Most participants seemed to be happy with research and hence rated their sense as good for 17<sup>th</sup> January.

On 18<sup>th</sup> Jan they began with a positive note “ because I am a research participant” That mood soon became “just about ok as work completion schedules not so simple”. On 19<sup>th</sup> January feeling states become neutral “ considering the amount of work to be completed”

## Appendix – 6: Consolidated Participant Daily Log

Participant Logs On:  
17-Jan-18 Wednesday

Participants	AM 08:00:00	AM 09:00:00	AM 10:00:00	AM 11:00:00	PM 12:00:00	PM 01:00:00	PM 02:00:00	PM 03:00:00	PM 04:00:00	PM 05:30:00	PM 06:00:00
A											2
B										2	
C										2	
D											3
E											2
F											2
G										3	
H										2	
I										3	
J										3	
K										2	
L										2	
M										3	
N										3	
O										3	
P										3	
Q										3	
R										3	
S										3	
T										3	
U										2	
V										2	
W										2	

Discussed On	Day
22-Jan-18	Monday
23-Jan-18	Tuesday
17-Jan-18	Wednesday
27-Jan-18	Saturday
27-Jan-18	Saturday
17-Jan-18	Wednesday
17-Jan-18	Wednesday
17-Jan-18	Wednesday
18-Jan-18	Thursday
19-Jan-18	Friday
19-Jan-18	Friday
19-Jan-18	Friday

Participant Logs On:  
18-Jan-18 Thursday

Participants	AM 08:00:00	AM 09:00:00	AM 10:00:00	AM 11:00:00	PM 12:00:00	PM 01:00:00	PM 02:00:00	PM 03:00:00	PM 04:00:00	PM 05:30:00	PM 06:00:00
A		3									3
B		3									3
C		3									2
D		3									3
E		2									3
F		3								2	
G		3									3
H		2									3
I		3									2
J				3						3	
K		2								3	
L		3								3	
M		3								3	
N		3								3	
O		3								3	
P		3								3	
Q		3								3	
R		2								3	
S		3								3	
T		3								3	
U		3								3	
V		3								3	
W		3								3	

Discussed On	Day
22-Jan-18	Monday
23-Jan-18	Tuesday
24-Jan-18	Wednesday
27-Jan-18	Saturday
24-Jan-18	Wednesday
24-Jan-18	Wednesday
24-Jan-18	Wednesday
18-Jan-18	Thursday
19-Jan-18	Friday

## Appendix – 7: Data Coding and Thematic Analysis

Ref: Dates	First Order Coding Analysis – Emotion Detection	Theoretical Affect Category	Participant classification	Causation	Aggregate Dimension
21/2/18 1/3/18 11/4/18 25/4/18 27/4/18 9/5/18 24/5/18	Statements indicating generalized traits of <b>gloominess</b> and <b>dejection</b> (e.g., "Have a general sense of unhappiness. I am not able to express in words but many a times a feeling of emptiness", "Chronic Sense of unease", "Feel <b>depressed</b> more", "Just the same, the weather itself is gloomy right. Just like that." "When I think, I am often sad for no reason", states of <b>hopelessness</b> (e.g., "I am just the same because after work, have to manage family, cook food. These thoughts seem to be affecting my mind while working." "Try repetitively to find a solution and then despair without achieving anything".	Low Activation, Unpleasant Affect (LAUA)	Seniors	Innate Mood without external triggers	Mood state
30/1/18 13/2/18 16/2/18 27/2/18 6/3/18 13/3/18 20/3/18 24/3/18 17/4/18 24/4/18 28/4/18 8/5/18 22/5/18 29/5/18 9/6/18	<b>Dejection</b> after supervisory critique became apparent with participant statements (e.g., "no new modules is depressing", "was feeling low..with the delivery expectation", "felt sad!"), <b>hopelessness</b> (e.g., "do not feel inspired", "whatever I am fine", "not really bothered by this", "I was just spending time", "going on" , "Tried my best but was ineffective"), <b>sluggishness</b> (e.g., "my mind does not work fast", "had a headache", "everyone was slow"), <b>Dullness</b> (e.g., "no one tells us how to complete faster", "was not sure what to say", "gave up on thinking more", "struggled to understand the meeting outcome", "Could not complete anything - mind was not working"), <b>Tiredness</b> (e.g., "work was tiring today", "more indecisive now..trying to pay attention but not happening", "my concentration span these days is limited", "was tired", "eyes were aching")	Low Activation, Unpleasant Affect (LAUA)	Juniors	Emotional reaction to triggers within the team	Emotional state
29/1/18 5/2/18 19/2/18 26/2/18	<b>Hopelessness</b> and lack of confidence was evident with participant statements (e.g., sighs saying "others have to spoon feed us now", "was ashamed", "pained nothing is working", "we had nothing to contribute", "Not finishing work is frustrating", "No cooperation. Everyone says they	Low Activation, Unpleasant Affect (LAUA)	Managers	Emotional reaction to triggers from	Emotional state

<p>5/3/18 12/3/18 19/3/18 26/3/18 2/4/18 9/4/18 23/4/18 30/4/18 7/5/18 14/5/18 21/5/18 28/5/18 4/6/18</p>	<p>are busy", "manufacturing has so many options and I feel like a.. dumbo", "feel very down with the feedbacks", <b>Dejection</b> (e.g., "pathetic..sense of emptiness", "feeling sorry, managing a challenge", "Appauling others look at us after narrating their ideas", "no words to express..very bad", "Nothing to cheer", "Depressing others are coming up with new proposals not us", "atrophied", "others can deliver, we thought we were the best. That unnerves me "), <b>Dullness</b> (e.g., " I am unable to think", "creative juices..i don't know", "my mind is heavy", "mind is cluttered to analyze", "thoughts are stuck") and <b>grouchiness</b> (e.g., "we have clerks. I am not able to focus", "team cannot think. How can I spoonfeed new ideas", "they are just making fanciful ppts", "ppts taking much time. Others have good colleagues to support", "project coordinator has no time for planning!", "resources allocated for futile exercise", "everyone tries to gain brownie points", "lame..nothing relevant and they talk about the training building")</p>			<p>outside the training team</p>	
---	--	--	--	----------------------------------	--

Ref: Dates	First Order Coding Analysis	Self-Ratings	Participant Affect classification	Category	Theoretical Category	Aggregate Dimension
<p>5/3/18 14/5/18 4/6/18</p> <p>6/2/18 20/3/18 3/4/18 24/4/18 22/5/18</p> <p>24/2/18 27/3/18 4/5/18 22/5/18</p>	<p>Upon rationalizing the wellbeing scores with task attainment, statements from participants indicated frustration with incomplete tasks and a direct reflection on wellbeing scores (e.g.,</p> <p>“ Annoys that nothing is completed, work is just piling”, “Its horrible, I have a long list of to dos”, “really bothered about my work efficiency”</p> <p>“It hurts that I cannot complete mundane tasks”, “Don’t understand why I take so much time”, “my head aches but I have no cold”, “ my mind was frozen that day..crap”, “I feel sick tired after doing nothing”,</p> <p>“Good, but work isn’t completed”, “ was ok but a lazy day, with loads to complete”, “was not effective today like a zombie”, “did not think coherently”)</p>	<p>4</p> <p>3</p> <p>3</p>	<p>Managers – (HAUA)</p> <p>Seniors – (LAUA)</p> <p>Juniors – (LAPA)</p>	<p>Self-rated Task Attainment</p>	<p>Task Execution</p>	<p>Productive Behavior</p>

<b>Ref: Dates</b>	<b>First Order Coding Analysis</b>	<b>Participant Affect classification</b>	<b>Category</b>	<b>Theoretical Category</b>	<b>Aggregate Dimension</b>
23/1/18 30/1/18 27/3/18	Observation of excuses made to evade responsibility (e.g., “I don’t want to be in charge, too much food on my plate”, “my computer is slower than usual”, “ have a family commitment to address; please no time with me”)	Seniors – (LAUA)	Participation and commitment	Task Execution	Productive Behavior
20/2/18 13/3/18 29/5/18	Observation of silence and non-participation in team meetings (e.g., Managers commented, “Lazy fellows, absolutely no interest or preparation”, “zero solutions from the team”, I observed a lack of interest and participation in meetings)	Juniors – (LAUA)			
16/3/18 3/4/18 17/4/18 22/5/18	Non-adherence to work ethics was observed with delays in submission, (e.g, “Had K3 to complete - focused all my energies there”), delays in entering into meetings (e.g, “ sorry I am late, was stuck in traffic”, “autos were less today”) and unplanned utilization of holidays.				
19/2/18 23/4/18 28/5/18	Observations of reluctance to stretch over-time to meet targets (e.g., “Cant stay back today”, “feel under the weather”, “sick and feverish”)				
12/3/18 16/4/18	Coming to terms with quality through justification and no additional efforts (e.g., “Had a lot of documentation to complete”, “going through the entire bunch was not practical”)				
9/4/18 7/5/18 21/5/18	Observed a blaming culture, arguments and a reactive behavior (e.g., “ This was your duty not mine”, “ You have to be responsible on your part”, “my schedules were delayed because of you”)				

## Appendix – 8: Task Attainment

**Aim:** To determine the degree of task attainment of participants in the pre and post intervention phases of the study

**Background:** It was observed during the course of the study that participants often gave a negative self rating when tasks for the day were not completed. The self ratings were subsequently categorized into innate Mood (emotional state without any specific reason) and reactionary emotions (emotional states in response to specific reasons at the workplace). It was seen that reactionary emotions were most likely noted on Mondays (when HOD meetings took place), Tuesdays (when departmental training meeting took place) and the day immediately prior to the Monday meeting (Working Saturday or Friday when preparation for the Monday meeting took place). Participant interactions often highlighted work related instances and lack of task completion as the primary reason for negative self-ratings on these days. As self perceived task attainment has been shown to positively influence job satisfaction and well being, and is a crucial determinant of it (Lai et al., 2010), I have considered the self ratings in the emotional (reaction) category as an indicator of task attainment.

On days when meetings did not take place (Wednesdays, Thursdays and some Fridays) and when there was less of a group emphasis and scrutiny on task completion, participants revealed an underlying mood state with no specific causation for their self ratings.

### **Procedure**

The self ratings under the reaction (emotion) category were listed month wise. Whenever participants listed more than one rating in a day, this listing only included the last recorded self rating for the day as there were similarities in the presented emotional states during the course of the day (Rothbard and Wilk, 2011). It also often reflected the summary of the by gone day's feeling states. These ratings were then categorized based on position into Managers, Seniors and Juniors. The number of times in a month when ratings of '4', '3', '2', '1' were self-rated was tabulated for each position (ie., Managers, Seniors and Juniors).

As corroborated during one to one discussions, participants used a self-rating of '4' to identify with lack of task attainment. '3' was used when work was completed but the participants did not feel satisfied. '2' was used when participants felt good after they completed the task. '1' was not used by participants during the pre-intervention phase. Therefore to analyze task completion in the pre-intervention period, total number of '3s' + '2s' + '1s' for a participant denoted task completion for the month.

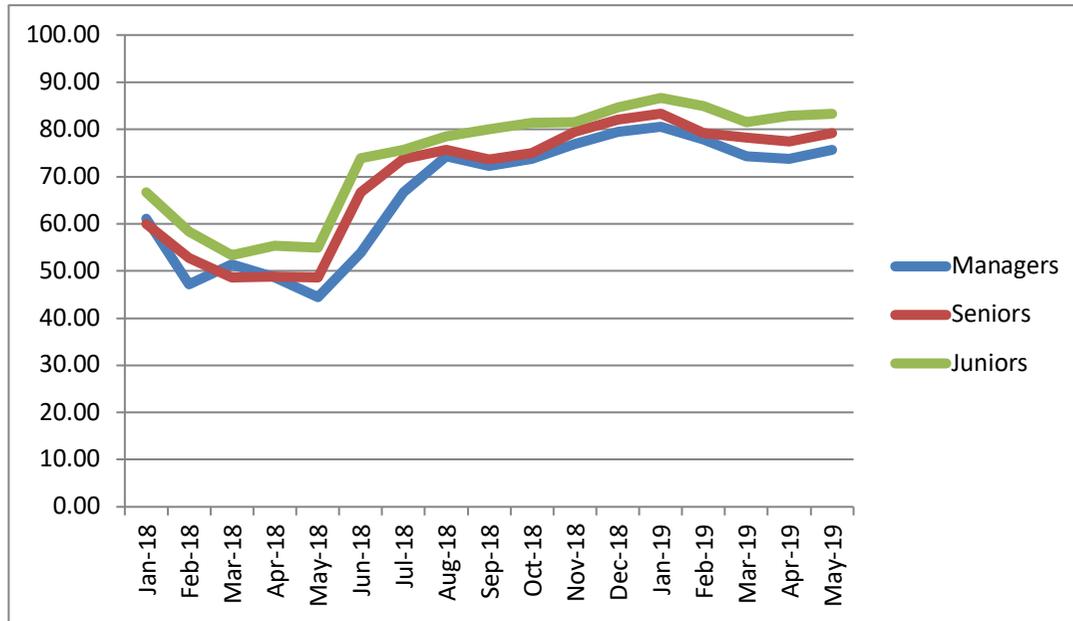
In the post intervention phase, participants gave a self rating of '1' upon task completion, '2' when tasks were progressing and would be completed soon, and '3' when tasks were not completed. '4' was seldom used by participants in the post intervention phase. This change on behalf of the participants in attributing a different task completion dimension to the self ratings were due to the change in participant mood profile noted after the intervention. Therefore to analyze task completion in the post intervention period, total number of '2s' + '1s' self ratings for a participant denoted task completion for the month.

Once the task completion was tabulated for each position and month, the percentage of completed tasks was determined and line charted to trend the post intervention changes. Average Task attainment percentage in a month = Task completions in the month/ Total attempted Tasks in the month

**Result:** Task completion rates improved in participants across all positions after the intervention.

**Number of times self ratings mentioned as '1', '2', '3', '4' in a month**

	<b>Managers</b>				<b>Seniors</b>				<b>Juniors</b>			
	<b>4'</b>	<b>3'</b>	<b>2'</b>	<b>1'</b>	<b>4'</b>	<b>3'</b>	<b>2'</b>	<b>1'</b>	<b>4'</b>	<b>3'</b>	<b>2'</b>	<b>1'</b>
<b>01/01/18</b>	7	10	1	0	14	17	4	0	10	18	2	0
<b>01/02/18</b>	19	17	0	0	34	36	2	0	25	34	1	0
<b>01/03/18</b>	17	18	0	0	37	34	1	0	28	30	2	0
<b>01/04/18</b>	20	19	0	0	41	39	0	0	29	36	0	0
<b>01/05/18</b>	20	16	0	0	37	35	0	0	27	33	0	0
<b>01/06/18</b>	18	15	6	0	26	27	19	6	17	19	20	9
<b>01/07/18</b>	0	14	20	8	0	22	44	18	0	17	35	18
<b>01/08/18</b>	0	10	19	10	0	19	39	20	0	14	30	21
<b>01/09/18</b>	0	10	17	9	0	19	29	24	0	12	26	22
<b>01/10/18</b>	0	11	23	8	0	20	36	24	0	13	36	21
<b>01/11/18</b>	0	9	23	7	0	16	37	25	0	12	30	23
<b>01/12/18</b>	0	8	17	14	0	14	34	30	0	10	29	26
<b>01/01/19</b>	0	7	23	6	0	12	31	29	0	8	27	25
<b>01/02/19</b>	0	8	23	5	0	15	35	22	0	9	29	22
<b>01/03/19</b>	0	10	16	13	0	17	38	23	0	12	28	25
<b>01/04/19</b>	0	11	19	12	0	19	40	25	0	12	29	29
<b>01/05/19</b>	0	9	17	11	0	15	36	21	0	10	28	22



**% task completed in a month**

Period	Managers	Seniors	Juniors
<b>Jan-18</b>	61.11	60.00	66.67
<b>Feb-18</b>	47.22	52.78	58.33
<b>Mar-18</b>	51.43	48.61	53.33
<b>Apr-18</b>	48.72	48.75	55.38
<b>May-18</b>	44.44	48.61	55.00
<b>Jun-18</b>	53.85	66.67	73.85
<b>Jul-18</b>	66.67	73.81	75.71
<b>Aug-18</b>	74.36	75.64	78.46
<b>Sep-18</b>	72.22	73.61	80.00
<b>Oct-18</b>	73.81	75.00	81.43
<b>Nov-18</b>	76.92	79.49	81.54
<b>Dec-18</b>	79.49	82.05	84.62
<b>Jan-19</b>	80.56	83.33	86.67
<b>Feb-19</b>	77.78	79.17	85.00
<b>Mar-19</b>	74.36	78.21	81.54
<b>Apr-19</b>	73.81	77.38	82.86
<b>May-19</b>	75.68	79.17	83.33

**Sample of Primary Data**

<b>Date</b>	<b>J</b>	<b>K</b>	<b>L</b>	<b>M</b>	<b>N</b>	<b>O</b>	<b>P</b>	<b>Q</b>	<b>R</b>	<b>S</b>	<b>T</b>	<b>U</b>	<b>V</b>	<b>W</b>
04/05/18	4	4	3	4	3	4	4	3	3	3	4	3	4	3
07/05/18	4	4	3	3	4	3	4	4	4	4	3	3	4	3
08/05/18	4	3	3	4	3	4	3	3	3	3	4	4	3	3
12/05/18	3	4	4	4	4	3	3	4	4	4	3	3	4	4
14/05/18	4	3	4	3	4	4	4	3	3	3	4	4	4	3
15/05/18	4	3	3	4	3	3	3	4	4	4	4	3	3	4
18/05/18	3	4	4	3	3	4	4	3	3	3	3	4	4	3
21/05/18	4	3	3	4	3	4	3	4	4	3	4	3	3	3
22/05/18	4	4	3	3	4	3	4	4	3	3	3	4	3	4
26/05/18	4	3	4	4	3	4	3	3	4	4	4	3	3	3
28/05/18	3	4	3	3	4	4	3	4	3	4	3	4	4	3
29/05/18	4	3	4	3	4	3	4	3	4	3	4	3	4	3

## **Appendix – 9: Absenteeism levels**

**Aim:** To understand the pre and post intervention levels of staff absenteeism.

**Attendance Policy:** Every individual working in the organization is entitled to 15 days of paid leave (PL) and 6 days of casual leave (CL) in a calendar year. Entitled leaves cannot be carried forward into the subsequent calendar year. However the remaining unutilized paid leaves at the end of the calendar year will be automatically monetized and paid to the employee during December payroll processing.

### **Organization Absence Policy**

Organization in practice allows flexible attendance and prioritises the policy of "All you have to do is to get the work done". Employees have to provide medical certificates in case of three or more days of unsanctioned leave

**Procedure:** To understand productivity, absenteeism due to illness and maternity leave were separated out (Heerwagen, 2000; Heerwagen and Wise, 1998; Montgomery et al., 1994). The absences that were planned and sanctioned in advance such as parental leave were also not included (Nicholson, 1977). As such the recorded leaves were the ones where the participants had no specific reasons and mentioned issues such as " my work was complete", "distance from home", " felt low".

These details were obtained from the Human resource portal during the study period and were with the researcher before the one to one meetings with participants. The monthly data of absences for each participants were retrieved as shown below. This data was then categorized into Managers, Seniors and Juniors for meaningful analysis.

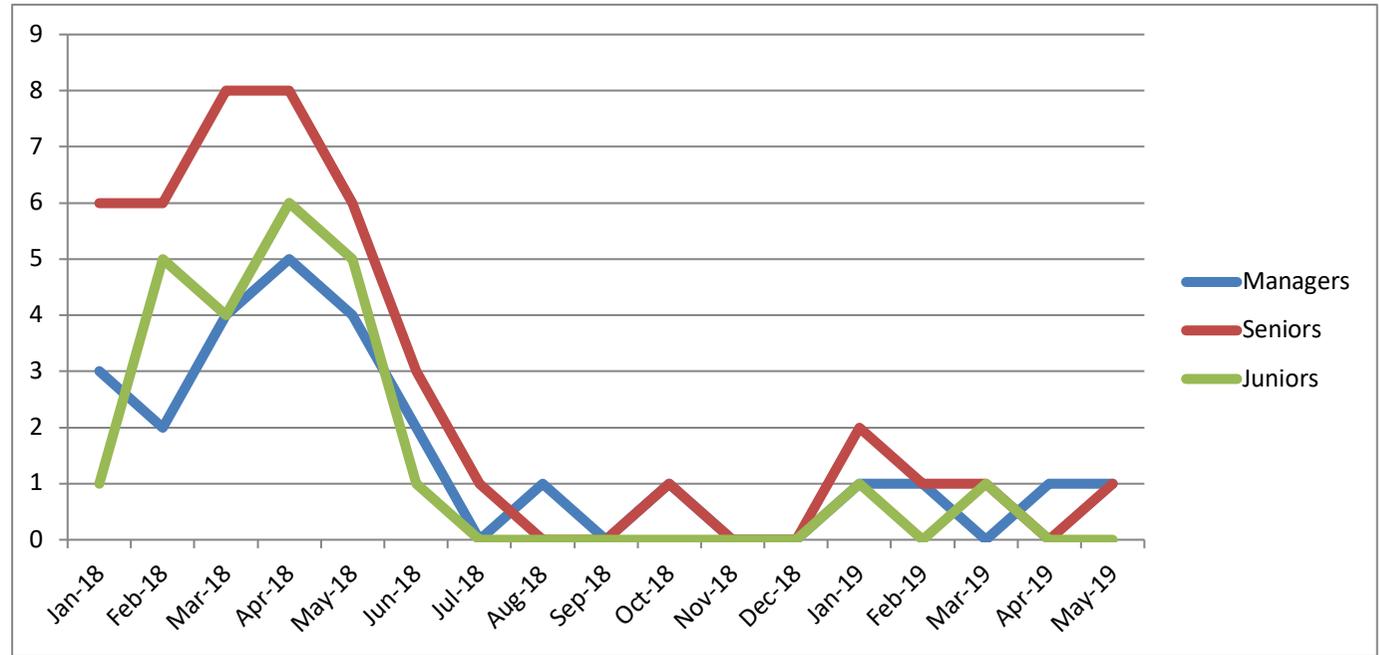
**Result:** Levels of absenteeism in participants reduced after the intervention. This is most probably due to increased levels of participant commitment and job involvement (Nicholson, 1977)

**Days of unplanned Monthly Absence**

	<b>J</b>	<b>K</b>	<b>L</b>	<b>M</b>	<b>N</b>	<b>O</b>	<b>P</b>	<b>Q</b>	<b>R</b>	<b>S</b>	<b>T</b>	<b>U</b>	<b>V</b>	<b>W</b>
<b>Jan-18</b>	2	1	0	1	1	2	1	0	1	0	0	0	1	0
<b>Feb-18</b>	1	1	0	0	2	2	1	1	0	1	1	1	1	1
<b>Mar-18</b>	1	2	1	2	1	1	1	1	2	2	1	0	0	1
<b>Apr-18</b>	2	1	2	1	0	2	1	1	3	1	2	1	1	1
<b>May-18</b>	1	2	1	2	1	0	1	1	1	1.5	1	0.5	1	1
<b>Jun-18</b>	1	1	0	1	1	0	0	1	0	0	0	1	0	0
<b>Jul-18</b>	0	0	0	1	0	0	0	0	0	0	0	0	0	0
<b>Aug-18</b>	1	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Sep-18</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Oct-18</b>	0	1	0	0	0	1	0	0	0	0	0	0	0	0
<b>Nov-18</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Dec-18</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Jan-19</b>	0	1	0	1	0	1	0	0	0	1	0	0	0	0
<b>Feb-19</b>	0	0	1	0	1	0	0	0	0	0	0	0	0	0
<b>Mar-19</b>	0	0	0	0	0	0	0	1	0	0	0	1	0	0
<b>Apr-19</b>	1	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>May-19</b>	0	0	1	1	0	0	0	0	0	0	0	0	0	0

### Monthly Participant Absenteeism

Period	Managers	Seniors	Juniors
Jan-18	3	6	1
Feb-18	2	6	5
Mar-18	4	8	4
Apr-18	5	8	6
May-18	4	6	5
Jun-18	2	3	1
Jul-18	0	1	0
Aug-18	1	0	0
Sep-18	0	0	0
Oct-18	1	1	0
Nov-18	0	0	0
Dec-18	0	0	0
Jan-19	1	2	1
Feb-19	1	1	0
Mar-19	0	1	1
Apr-19	1	0	0
May-19	1	1	0



Monthly Participant Absenteeism

## **Appendix – 10: Work time Duration**

**Aim:** To understand the average daily work duration during the pre and post intervention phases.

**Work Duration Policy:** Formal work timings in the organization start at 9AM and end by 5:30 PM. The timings include a 1 hour lunch break with a suggested total working time duration of least 7.5 hours every working day.

### **Employee Work duration in practice**

Organization practices flexible work timings in accordance with its policy "All you have to do is to get the work done". Often employees work beyond the stipulated work timings to meet work targets. Access to the work desks and office premises are time monitored with biometric access control that clock the time of entry and exit. Besides human resource monitoring, they primarily existed in the organization to meet automated documentation protocols and compliances that is stipulated and required by the industry.

**Procedure:** To understand productivity, average daily time spent at work in a month were obtained for the participants from the Administration portal. These details were then categorized into Managers, Seniors and Juniors, and then averaged across the respective categories for meaningful analysis.

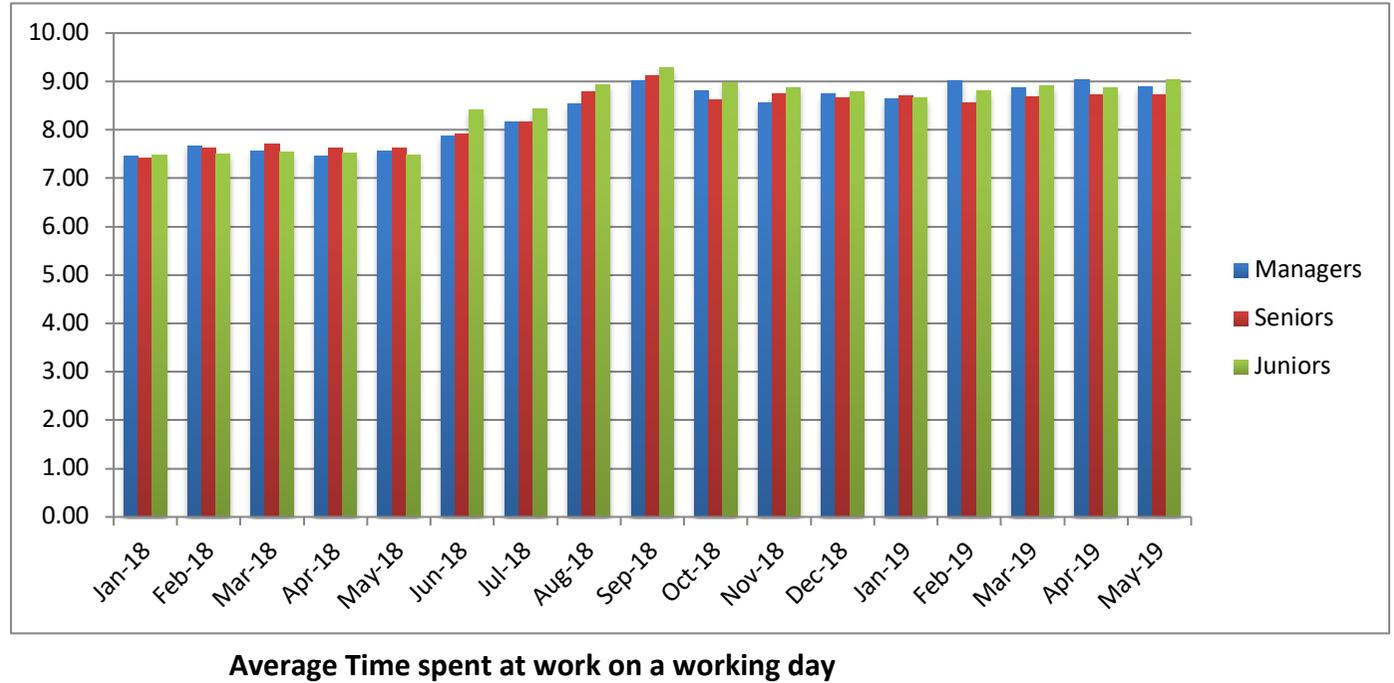
**Result:** Average daily work duration increased after the intervention.

**Average work duration in a day month wise**

	<b>J</b>	<b>K</b>	<b>L</b>	<b>M</b>	<b>N</b>	<b>O</b>	<b>P</b>	<b>Q</b>	<b>R</b>	<b>S</b>	<b>T</b>	<b>U</b>	<b>V</b>	<b>W</b>
<b>Jan-18</b>	7.5	7.5	7.4	7.5	7.5	7.55	7.4	7.1	7.4	7.3	7.5	7.55	7.5	7.5
<b>Feb-18</b>	7.7	7.8	7.5	7.6	7.5	7.9	7.5	7.7	7.5	7.5	7.5	7.5	7.5	7.522
<b>Mar-18</b>	7.5	7.6	7.6	7.8	7.5	7.6	7.7	7.85	7.75	7.61	7.5	7.5	7.5	7.55
<b>Apr-18</b>	7.5	7.4	7.5	7.9	7.7	7.5	7.55	7.7	7.45	7.5	7.6	7.5	7.5	7.5
<b>May-18</b>	7.7	7.5	7.5	7.8	7.85	7.5	7.5	7.52	7.56	7.33	7.5	7.5	7.5	7.6
<b>Jun-18</b>	8	8.1	7.5	7.9	8	7.95	8	7.5	8.2	8.5	8.6	8.2	8.5	8.3
<b>Jul-18</b>	8.2	8.3	8	8.5	8	8.25	8.2	8.1	7.9	8	8.4	8.5	8.6	8.7
<b>Aug-18</b>	8.5	8.5	8.6	8.8	8.9	8.6	8.75	8.85	8.8	9	8.7	9	9	9
<b>Sep-18</b>	8.9	9	9.15	9.35	9.2	8.9	9.2	8.95	9.1	9	9.25	9.3	9.4	9.5
<b>Oct-18</b>	8.9	9	8.5	8.9	8.4	8.6	8.6	8.9	8.35	8.7	8.9	9	9	9.3
<b>Nov-18</b>	8.5	8.6	8.6	8.9	8.8	8.65	8.9	8.7	8.5	8.6	9	8.95	9	8.8
<b>Dec-18</b>	8.65	8.79	8.78	9	8.84	8.98	8.4	8.2	8.55	8.8	8.5	8.9	8.7	9
<b>Jan-19</b>	8.54	8.65	8.72	8.85	8.9	8.95	8.75	8.34	8.42	8.7	8.54	8.73	8.55	8.78
<b>Feb-19</b>	9	9.1	8.95	8.52	8.81	8.67	8.54	8.4	8.38	9.1	8.69	8.7	8.97	8.59
<b>Mar-19</b>	8.8	9.12	8.71	8.8	8.84	8.75	8.66	8.52	8.47	8.95	8.89	8.95	8.77	8.97
<b>Apr-19</b>	8.69	9.34	9.08	8.79	8.89	8.81	8.61	8.67	8.57	8.79	8.71	8.9	8.91	9
<b>May-19</b>	8.59	8.93	9.14	8.87	8.78	8.7	8.91	8.5	8.6	9.07	8.91	8.96	9.17	9.07

**Average Time spent at work on a working day**

Period	Managers	Seniors	Juniors
Jan-18	7.47	7.41	7.47
Feb-18	7.67	7.62	7.50
Mar-18	7.57	7.70	7.53
Apr-18	7.47	7.63	7.52
May-18	7.57	7.62	7.49
Jun-18	7.87	7.93	8.42
Jul-18	8.17	8.16	8.44
Aug-18	8.53	8.78	8.94
Sep-18	9.02	9.12	9.29
Oct-18	8.80	8.63	8.98
Nov-18	8.57	8.74	8.87
Dec-18	8.74	8.66	8.78
Jan-19	8.64	8.70	8.66
Feb-19	9.02	8.55	8.81
Mar-19	8.88	8.67	8.91
Apr-19	9.04	8.72	8.86
May-19	8.89	8.73	9.04



## **Appendix – 11: Financial Measures**

**Aim:** To understand financial measures in the pre and post intervention study period.

**Measures:** I use orders in hand as a reflection of the financial measures to respect organization confidentialities. This becomes valid as the cycle times to execute an order is often less than a month and the conversion of orders into revenues during the study period was confirmed. It was also reasoned that Orders in hand will mirror an immediate acceleration or deceleration in the department revenue landscape with new initiatives and work dynamism or lack of thereof.

Profitability figures were then analyzed for the study period.

**Procedure:** To conceal revenues, orders in hand within the training division for the month of January 2018 was given a base figure of 100. Figures of subsequent months were indexed against this. Similarly, profitability for the training division was indexed against the loss incurred in January 2018 with a base figure of -0.15 as reference. Rescaling was done based on the below formulas:

1)  $\text{Order in hand for January 2018 in absolute value} / \text{Order in hand for the respective month} = 100$

2)  $\text{Profitability for January 2018 in absolute value} / \text{Profitability for the respective month} = -.15$

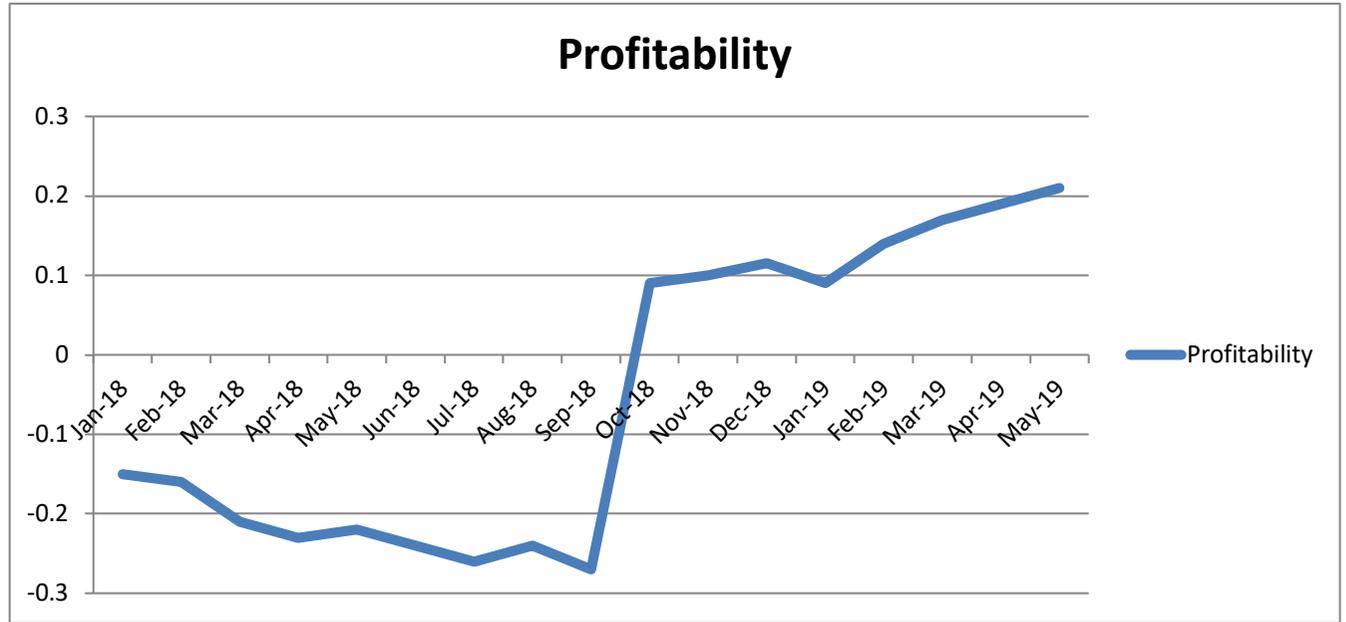
The figures were then charted into a line graph for trend analysis.

**Result:** Orders in hand showed a progressive increase from October 2018. This could be attributed to increased initiatives from participants. Profitability also showed an increase from October 2018. This is because of the increase in turnover and decrease in operational expenses. However, January 2019 showed a decrease in profitability due to increased opex related to a new stream of activity. Profitability then increased in subsequent months helped by an increase in revenues and enhanced operational efficiency.

Period	Monthly Orders in hand
Jan-18	100.00
Feb-18	98.92
Mar-18	101.08
Apr-18	104.30
May-18	95.70
Jun-18	97.85
Jul-18	97.30
Aug-18	101.08
Sep-18	98.85
Oct-18	104.30
Nov-18	105.38
Dec-18	118.28
Jan-19	117.75
Feb-19	132.26
Mar-19	138.71
Apr-19	140.86
May-19	149.46



Period	Profitability
Jan-18	-0.15
Feb-18	-0.16
Mar-18	-0.21
Apr-18	-0.23
May-18	-0.22
Jun-18	-0.24
Jul-18	-0.26
Aug-18	-0.24
Sep-18	-0.27
Oct-18	0.09
Nov-18	0.1
Dec-18	0.115
Jan-19	0.09
Feb-19	0.14
Mar-19	0.17
Apr-19	0.19
May-19	0.21



## **Appendix – 12: Average Monthly Customer Feedback**

**Aim:** To determine any changes in customer feedbacks during the post intervention period.

**Customer feedback policy:** After every service delivery, feedback is solicited from the customer by every employee involved in the assignment. The feedback form is provided with a question, "How did we meet your expectations?" followed by 5 options to choose from:

'5' - Fell well short of expectations

'4' - Not quite met expectations

'3' - Met expectations

'2' - Better than expected

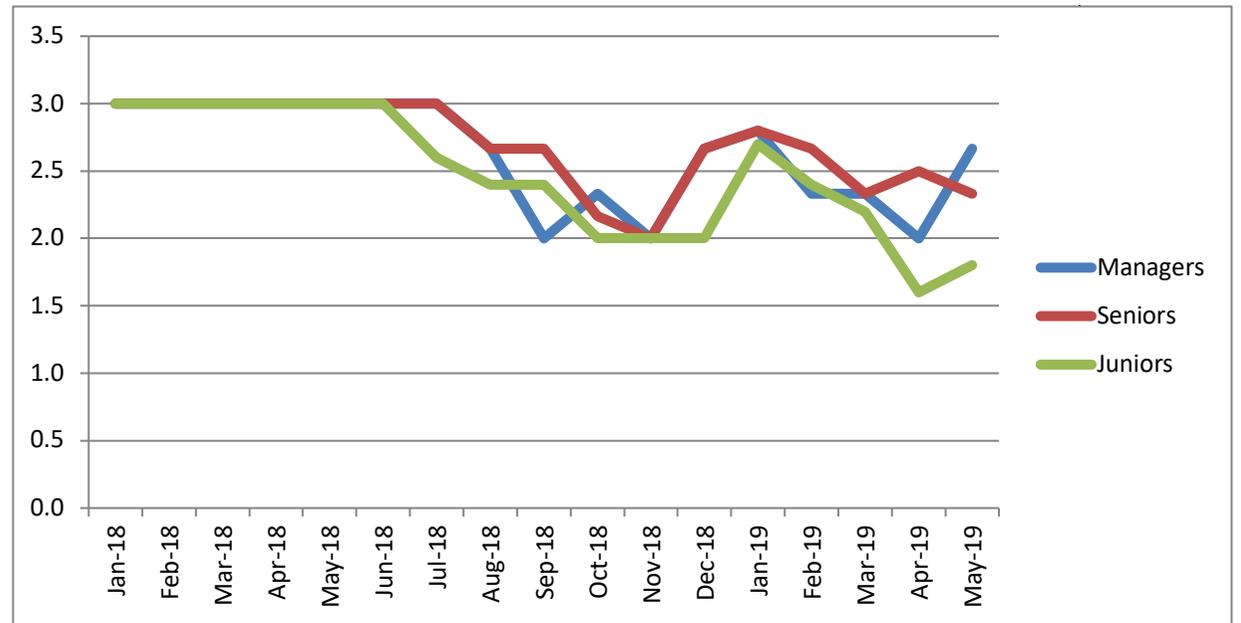
'1' - Far exceed expectations

In addition, the feedback form also has a descriptive section for customers to describe situations and write feedbacks.

**Procedure:** Customer feedbacks for each participant were retrieved from the personnel MIS portal. Participant averages for each month and categorized into positions (I.e. Managers, Seniors, Juniors) were captured from the system and reproduced in an excel spreadsheet. The data was then categorized into positions (I.e. Managers, Seniors, Juniors) for analysis. . Participant averages for each month were captured from the system and reproduced in an excel spreadsheet. The data was then categorized into positions (I.e. Managers, Seniors, Juniors) for analysis.

**Result:** Customer feedbacks showed an improvement in the post intervention phase. Until the intervention, customers across spectrums mentioned '3 - Met Expectations' as the default feedback. This has to be viewed in the context where individuals in Asia desist from giving negative feedbacks. Post intervention, juniors achieved superior feedbacks ('2 - Better than expected' ) initially. This trend was subsequently followed by Seniors and Managers in the coming months. This indicated an increased application of creativity and addition of novelty in service delivery. However ratings were often sporadic and no trend could be observed on a chart during the study period. This could be because of differences amongst customers, need to impress upon the customer to exceed expectations and similar service deliveries to the same customer.

Period	Managers	Seniors	Juniors
Jan-18	3.0	3.0	3.0
Feb-18	3.0	3.0	3.0
Mar-18	3.0	3.0	3.0
Apr-18	3.0	3.0	3.0
May-18	3.0	3.0	3.0
Jun-18	3.0	3.0	3.0
Jul-18	3.0	3.0	2.6
Aug-18	2.7	2.7	2.4
Sep-18	2.0	2.7	2.4
Oct-18	2.3	2.2	2.0
Nov-18	2.0	2.0	2.0
Dec-18	2.7	2.7	2.0
Jan-19	2.8	2.8	2.7
Feb-19	2.3	2.7	2.4
Mar-19	2.3	2.3	2.2
Apr-19	2.0	2.5	1.6
May-19	2.7	2.3	1.8



**Sample of Primary Data**

<b>Period</b>	<b>J</b>	<b>K</b>	<b>L</b>	<b>Average</b>	<b>M</b>	<b>N</b>	<b>O</b>	<b>P</b>	<b>Q</b>	<b>R</b>	<b>Average</b>	<b>S</b>	<b>T</b>	<b>U</b>	<b>V</b>	<b>W</b>	<b>Average</b>
May-18	3	3	3	3.0	3	3	3	3	3	3	3.0	3	3	3	3	3	3
Jun-18	3	3	3	3.0	3	3	3	3	3	3	3.0	3	3	3	3	3	3
Jul-18	3	3	3	3.0	3	3	3	3	3	3	3.0	2	3	2	3	3	2.6
Aug-18	3	3	2	2.7	2	3	3	3	3	2	2.7	3	2	2	3	2	2.4
Sep-18	2	2	2	2.0	2	3	3	3	3	2	2.7	3	2	2	3	2	2.4
Oct-18	2	2	3	2.3	2	2	2	3	2	2	2.2	2	2	2	2	2	2
Nov-18	2	2	2	2.0	2	2	2	2	2	2	2.0	2	2	2	2	2	2

## **Appendix – 13: Process and performance measures**

**Aim:** To understand the participant appraisal ratings during the pre and post intervention phases.

**Appraisal Policy:** Every employee in the organization has a half yearly appraisal cycle in June and December. The appraisal process has 10% of the total weightage given for compliance to standardized processes. The remaining 90% of the appraisal includes performance measures to determine how well an individual or a team achieves its work objectives. The ratings have a scale of '1' to '5' with the following options to choose from

'5' - Fell well short of expectations

'4' - Not quite met expectations

'3' - Met expectations

'2' - Better than expected

'1' - Far exceed expectations

The ratings are allocated by the line managers in discussion with reportees.

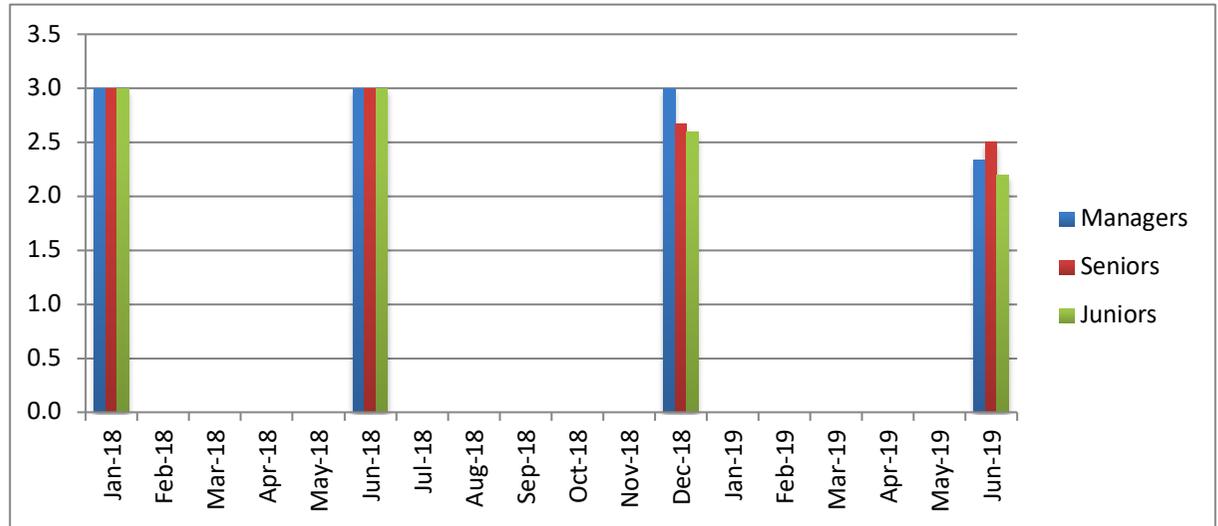
**Procedure:** To understand performance measures, manager ratings of reportees were collected from the personnel portal. The ratings were segregated into performance measures and ISO compliance, and subsequently charted for trend analysis. The aggregate participant rating that evolved from the appraisal procedure was not considered for the purpose of this study.

**Result:** I found that the degree of openness in the appraisal process increased after the intervention. Pre-intervention, managers tended to give an average rating of '3 - Met Expectations' as the default supervisory rating. Post-intervention, I observed better reasoned out supervisory ratings across participants for ISO compliance and performance. There was also an increased degree of communication and openness between the line managers and their reports.

### ISO Compliance Ratings

	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
<b>Jan-18</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>Jun-18</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>Dec-18</b>	3	3	3	2	3	3	2	3	3	2	2	3	3	3
<b>Jun-19</b>	3	2	2	2	3	2	2	3	3	2	2	3	2	2

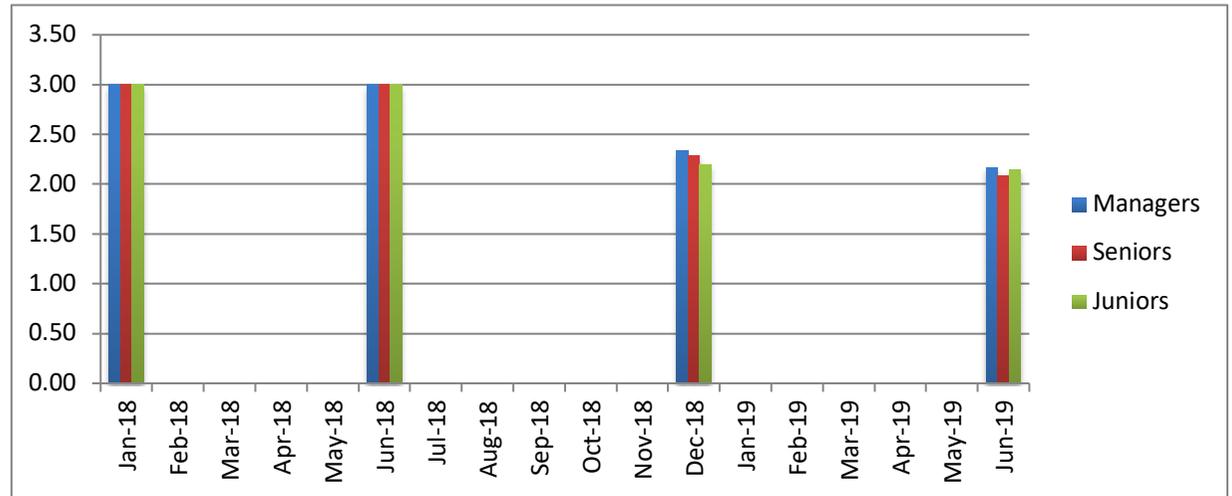
	Managers	Seniors	Juniors
<b>Jan-18</b>	3.0	3.0	3
<b>Jun-18</b>	3.0	3.0	3
<b>Dec-18</b>	3.0	2.7	2.6
<b>Jun-19</b>	2.3	2.5	2.2



**Performance ratings**

	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
<b>Jan-18</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>Jun-18</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>Dec-18</b>	2.5	2	2.5	1.5	2.5	2.5	2	2.5	2.75	1.5	1.5	2.5	2.75	2.75
<b>Jun-19</b>	2.5	2	2	1.5	2	2	2	2.5	2.5	1.5	1.5	2.5	2.75	2.5

	Managers	Seniors	Juniors
<b>Jan-18</b>	3.00	3.00	3.00
<b>Jun-18</b>	3.00	3.00	3.00
<b>Dec-18</b>	2.33	2.29	2.20
<b>Jun-19</b>	2.17	2.08	2.15



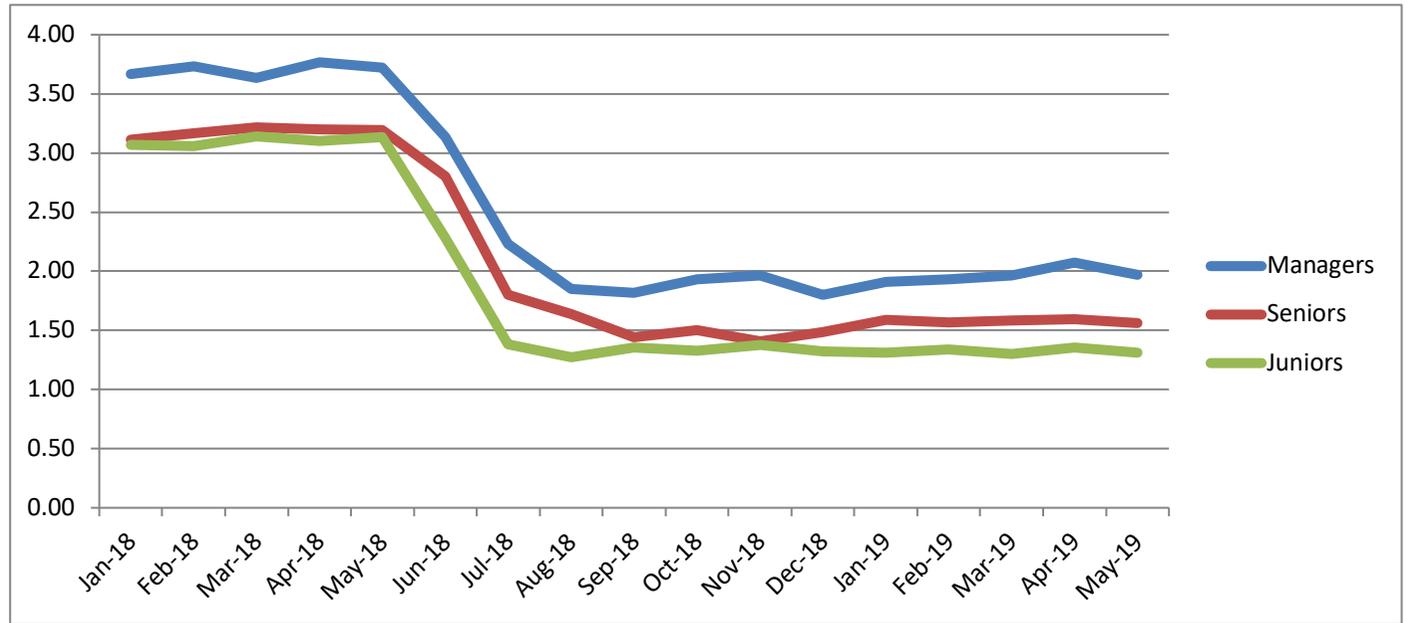
## **Appendix – 14: Mood state analysis**

**Aim:** To understand the mood states from the self ratings.

**Procedure:** Self ratings under the innate (Mood) category (i.e. ones that did not have a specific cause for the feeling state) were listed. Whenever participants listed more than one rating in a day, this listing only included the last recorded self rating for the day as there were similarities in the presented mood states during the course of the day (Rothbard, 2016). They were then categorized into pertinent months and positions (i.e. Managers, Seniors and Juniors). The average ratings for each position in a month was calculated and charted.

**Result:** Average self ratings indicated an improvement in mood states across all positions after the intervention.

Period	Managers	Seniors	Juniors
Jan-18	3.67	3.11	3.07
Feb-18	3.73	3.17	3.06
Mar-18	3.63	3.22	3.14
Apr-18	3.77	3.20	3.10
May-18	3.72	3.19	3.13
Jun-18	3.13	2.80	2.28
Jul-18	2.23	1.80	1.38
Aug-18	1.85	1.64	1.27
Sep-18	1.81	1.44	1.36
Oct-18	1.93	1.50	1.33
Nov-18	1.96	1.41	1.38
Dec-18	1.80	1.48	1.32
Jan-19	1.91	1.59	1.31
Feb-19	1.93	1.57	1.34
Mar-19	1.97	1.58	1.30
Apr-19	2.07	1.59	1.36
May-19	1.97	1.56	1.31



**Sample of  
Primary Data**

Date	J	K	L	Average	M	N	O	P	Q	R	Average	S	T	U	V	W	Average
04/04/18	4	4	4		4	3	3	3	3	4		3	3	3	3	3	
05/04/18	3	4	3		3	4	4	3	4	3		3	3	3	4	3	
11/04/18	4	3	4		4	3	3	3	3	3		3	3	3	3	3	
12/04/18	3	3	4		3	3	3	3	3	4		3	4	3	3	3	
13/04/18	4	4	4		3	3	3	3	3	3		3	3	3	3	3	
18/04/18	3	4	3		3	4	3	3	3	3		3	3	3	3	3	
19/04/18	4	4	4		3	3	3	3	3	4		3	3	3	3	3	
25/04/18	4	4	4		3	3	4	4	3	3		3	3	3	3	4	
26/04/18	4	4	4		3	3	3	3	4	3		3	3	3	3	3	
27/04/18	4	4	4	3.8	3	3	3	3	3	3	3.2	4	3	4	3	3	3.1

## **Appendix – 15: Process and Performance Measures in the new built environment**

**Aim:** To understand participant appraisal ratings in the old and new built environments.

**Appraisal Policy:** Every employee in the organization has a half yearly appraisal cycle in June and December. The appraisal process has 10% of the total weightage given for compliance to standardized processes. The remaining 90% of the appraisal includes performance measures to determine how well an individual or a team achieves its work objectives. The ratings have a scale of '1' to '5' with the following options to choose from

'5' - Fell well short of expectations

'4' - Not quite met expectations

'3' - Met expectations

'2' - Better than expected

'1' - Far exceed expectations

The ratings are allocated by the line managers in discussion with reportees.

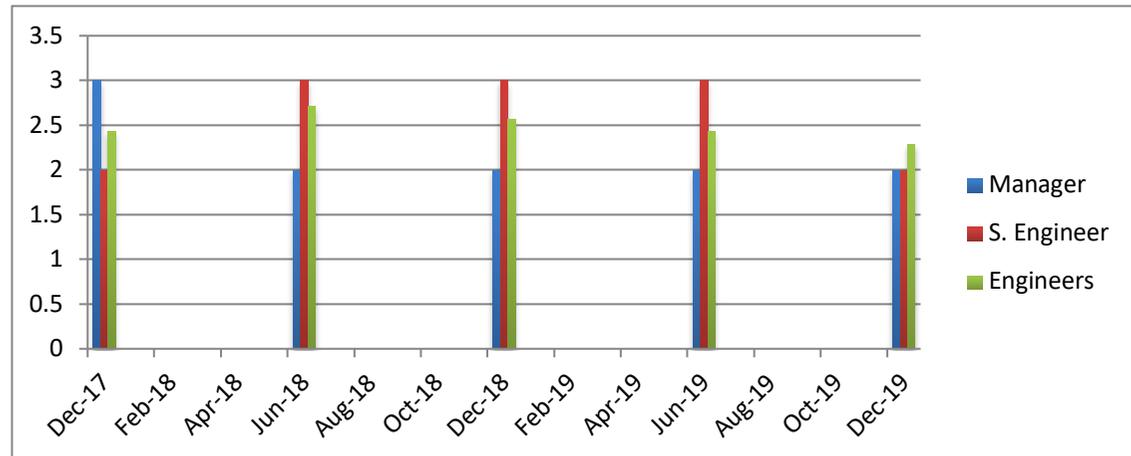
**Procedure:** To understand performance measures, supervisor ratings of reportees were collected from the personnel portal. The ratings were segregated into performance measures and ISO compliance, and subsequently charted with position averages for trend analysis. The aggregate participant rating that evolved from the appraisal procedure was not considered for the purpose of this study.

**Result:** I found that in the old built environment, HR data suggested that participants engaged in constructive, deliberative and consensus oriented appraisal process. I noted marginal improvements in performance measures in the new built environment, although the number of participants and study period was a limiting factor in identifying a trend. More participants were also recognized for their contribution to bettering ISO processes in the new built environment.

### Performance ratings

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>I</b>
<b>Dec-17</b>	3	2	2	3	2	2	3	2	3
<b>Jun-18</b>	2	3	3	3	3	2	3	3	2
<b>Dec-18</b>	2	3	2	3	2	3	2	3	3
<b>Jun-19</b>	2	3	3	2	2	2	3	3	2
<b>Dec-19</b>	2	2	2	2	3	3	2	2	2

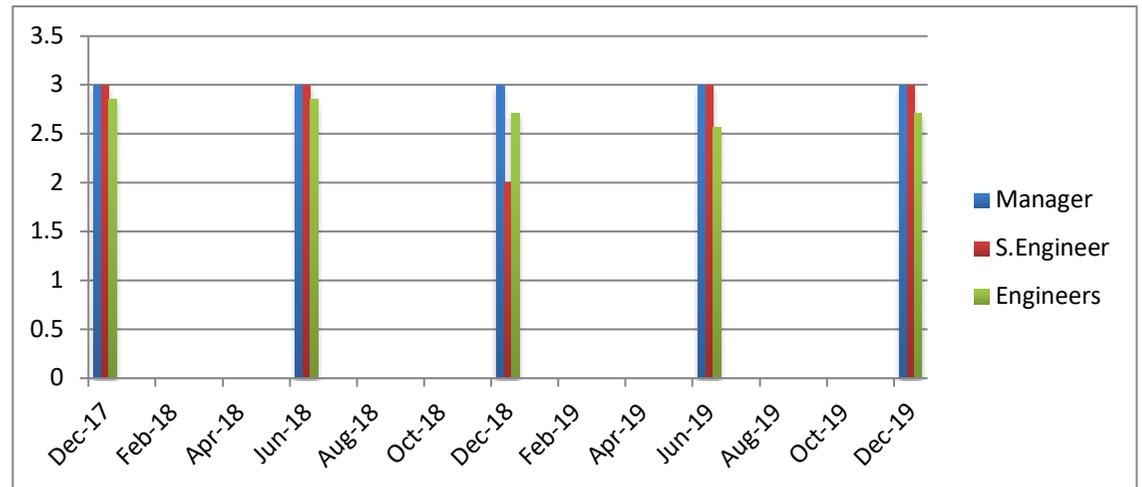
	<b>Manager</b>	<b>S. Engineer</b>	<b>Engineers</b>
<b>Dec-17</b>	3	2	2.42857143
<b>Jun-18</b>	2	3	2.71428571
<b>Dec-18</b>	2	3	2.57142857
<b>Jun-19</b>	2	3	2.42857143
<b>Dec-19</b>	2	2	2.28571429



### ISO compliance

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>I</b>
<b>Dec-17</b>	3	3	3	2	3	3	3	3	3
<b>Jun-18</b>	3	3	3	3	3	3	2	3	3
<b>Dec-18</b>	3	2	3	3	3	3	3	2	2
<b>Jun-19</b>	3	3	3	3	2	2	2	3	3
<b>Dec-19</b>	3	3	3	3	3	2	3	2	3

	<b>Manager</b>	<b>S.Engineer</b>	<b>Engineers</b>
<b>Dec-17</b>	3	3	2.85714286
<b>Jun-18</b>	3	3	2.85714286
<b>Dec-18</b>	3	2	2.71428571
<b>Jun-19</b>	3	3	2.57142857
<b>Dec-19</b>	3	3	2.71428571



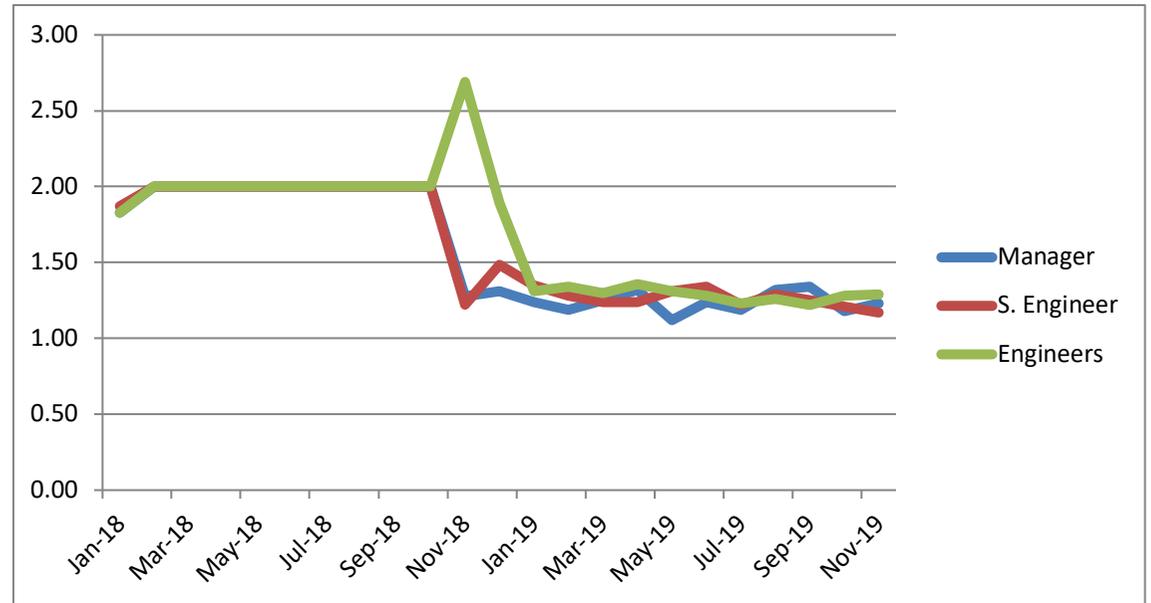
## **Appendix – 16: Mood state analysis in the new built environment**

**Aim:** To understand the mood states from the self ratings.

**Procedure:** Self ratings under the innate (Mood) category (I.e. ones that did not have a specific cause for the feeling state) were listed. Whenever participants listed more than one rating in a day, this listing only included the last recorded self rating for the day as there were similarities in the presented mood states during the course of the day (Rothbard, 2016). They were then categorized into pertinent months and positions (I.e. Manager, Senior Engineer and Engineers). The average ratings for each position in a month was calculated and charted.

**Result:** I observed that production department participant mood states were displayed during periods of less work in line with the cyclical nature of project execution intensity. Average self ratings of mood states during lean periods indicated an improvement in mood states across all positions in the new built environment. Manager and engineer presented an almost immediate improvement in mood state. However, mood states of engineers worsened for about three weeks in the new built environment. The mood state then improved and stabilized to a largely '1' self rating during the remaining period of the study.

Period	Manager	S. Engineer	Engineers
Jan-18	1.83	1.87	1.83
Feb-18	2.00	2.00	2.00
Mar-18	2.00	2.00	2.00
Apr-18	2.00	2.00	2.00
May-18	2.00	2.00	2.00
Jun-18	2.00	2.00	2.00
Jul-18	2.00	2.00	2.00
Aug-18	2.00	2.00	2.00
Sep-18	2.00	2.00	2.00
Oct-18	2.00	2.00	2.00
Nov-18	1.28	1.22	2.69
Dec-18	1.31	1.48	1.89
Jan-19	1.24	1.35	1.31
Feb-19	1.19	1.28	1.34
Mar-19	1.25	1.24	1.30
Apr-19	1.32	1.24	1.36
May-19	1.12	1.31	1.31
Jun-19	1.24	1.34	1.28
Jul-19	1.19	1.22	1.23
Aug-19	1.32	1.29	1.26
Sep-19	1.34	1.25	1.22
Oct-19	1.18	1.21	1.28
Nov-19	1.23	1.17	1.29



## **Appendix – 17: Work Days**

**Aim:** To compile the working days in the study

**Procedure:** Dates in the consolidated participant log (Appendix 6) of self-reports and interviews were tabulated chronologically. They were then separated into respective months and counted using the count function in Microsoft excel. Start and End dates of the different phases in intervention and developmental studies were noted and recorded.

**Result:** Data for a total of 513 work days were analysed in the study.

<b>Study dates</b>	<b>Year</b>	<b>Month</b>	<b>Working days</b>				
Friday, 19 January 2018	2018	January	9				
Monday, 22 January 2018	2018	February	22	From	Friday, 19 January 2018	Pre-intervention data	92 work
Tuesday, 23 January 2018	2018	March	23	To	Monday, 21 May 2018	collection	days
Wednesday, 24 January 2018	2018	April	23	From	Wednesday, 23 May 2018	Renovation period data	15 work
Thursday, 25 January 2018	2018	May	24	To	Sunday, 10 June 2018	collection	days
Saturday, 27 January 2018	2018	June	23	From	Monday, 11 June 2018	Post-intervention data	269 work
Monday, 29 January 2018	2018	July	24	To	Friday, 31 May 2019	collection	days
Tuesday, 30 January 2018	2018	August	24				
Wednesday, 31 January 2018	2018	September	21				
	2018	October	24				
Thursday, 1 February 2018	2018	November	22	From	Friday, 19 January 2018	Pre-occupancy data	221 work
Friday, 2 February 2018	2018	December	23	To	Wednesday, 7 November 2018	collection	days
Monday, 5 February 2018				From	Monday, 12 November 2018	Post-occupancy data	290 work
Tuesday, 6 February 2018	2019	January	23	To	Friday, 29 November 2019	collection	days
Wednesday, 7 February 2018	2019	February	22				
Thursday, 8 February 2018	2019	March	23				
Friday, 9 February 2018	2019	April	23				
Saturday, 10 February 2018	2019	May	24				
Monday, 12 February 2018	2019	June	22				
Tuesday, 13 February 2018	2019	July	25				
Wednesday, 14 February 2018	2019	August	23				
Thursday, 15 February 2018	2019	September	22				
Friday, 16 February 2018	2019	October	22				
Monday, 19 February 2018	2019	November	22				
Tuesday, 20 February 2018							
Wednesday, 21 February 2018							
Thursday, 22 February 2018							
Friday, 23 February 2018							
Saturday, 24 February 2018							
Monday, 26 February 2018							
Tuesday, 27 February 2018							
Wednesday, 28 February 2018							

## **Appendix – 18: Compilation of Self-reports**

**Aim:** To determine the number of daily and monthly self reports.

**Procedure:** Participant self reports in the consolidated participant log were arranged chronologically into days and months.

**Result:** Data from a total of 9745 self-reports were analysed in the study.

<b>Number of daily participant self-reports</b>		
	<b>Intervention study</b>	<b>Developmental study</b>
Friday, 19 January 2018	14	9
Monday, 22 January 2018	14	9
Tuesday, 23 January 2018	14	9
Wednesday, 24 January 2018	13	9
Thursday, 25 January 2018	14	9
Saturday, 27 January 2018	13	9
Monday, 29 January 2018	14	9
Tuesday, 30 January 2018	14	8
Wednesday, 31 January 2018	13	9
<b>Sub-total</b>	<b>123</b>	<b>80</b>
Thursday, 1 February 2018	13	9
Friday, 2 February 2018	14	9
Monday, 5 February 2018	14	9
Tuesday, 6 February 2018	13	9
Wednesday, 7 February 2018	13	9
Thursday, 8 February 2018	14	9
Friday, 9 February 2018	12	9
Saturday, 10 February 2018	13	9
Monday, 12 February 2018	14	9
Tuesday, 13 February 2018	13	9
Wednesday, 14 February 2018	14	8
Thursday, 15 February 2018	12	9
Friday, 16 February 2018	14	9
Monday, 19 February 2018	13	9
Tuesday, 20 February 2018	13	9

<b>Number of Monthly Participant self reports</b>			
		<b>Intervention study</b>	<b>Developmental study</b>
<b>2018</b>	January	123	80
	February	295	196
	March	306	206
	April	303	207
	May	321	215
	June	316	207
	July	335	215
	August	335	216
	September	294	187
	October	334	216
	November	308	197
	December	322	207
<b>2019</b>	January	318	206
	February	305	198
	March	309	206
	April	306	204
	May	317	216
	June		198
	July		224
	August		206
	September		198
	October		196
	November		197
<b>Total self reports</b>		<b>5147</b>	<b>4598</b>

<b>Summary of self-report data</b>	
Pre-intervention	1222
Renovation	185
Post-intervention	3740
<b>Total</b>	<b>5147</b>
Pre-occupancy	1981
Post-occupancy	2617
<b>Total</b>	<b>4598</b>
<b>Total self reports in the study</b>	<b>9745</b>

## **Appendix – 19: Interviews**

**Aim:** To determine the time and number of interviews in the study.

**Procedure:** Data in the researcher daily journal (Appendix 5) was sorted according to dates and participants in the consolidated participant daily log (Appendix 6). This data was then arranged in a chronological order with time taken for the interviews. Daily and monthly interview quantum was determined and sorted into occupancy and interview studies as shown below.

**Result:** A total of 1547 interviews were conducted over 518 hours during the period of the study.

Interview Days	Participants	Number of Interviews	Time in minutes	Monthly time		Monthly interviews		2018	Month	Interventi	Develop		
				Develop	Interve	Develop	Interven			on	mental		
Friday, 19 January 2018	T, U,V,W	4	80						January	290	300		
Monday, 22 January 2018	A, B,C,D	4	60						February	1230	880	<b>Total number of interviews</b>	1547
Tuesday, 23 January 2018	E,F,G,H	4	60						March	1040	570	<b>Intervention study</b>	
Wednesday, 24 January 2018	I, M, N	3	70						April	640	650	Pre-intervetion	160
Thursday, 25 January 2018	P,Q,R,S	4	90						May	1120	580	Renovation	29
Saturday, 27 January 2018	J,K,L	3	90						June	1110	560	post intrrvention	554
Monday, 29 January 2018	A,B,C,D	4	80						July	1080	680	<b>Developmental study</b>	
Tuesday, 30 January 2018	E,G,H	3	60						August	1240	540	Predevelopmental	345
Wednesday, 31 January 2018	Researcher not present	0	0	<b>300</b>	<b>290</b>	<b>16</b>	<b>13</b>		September	880	540	Post developmental	459
Thursday, 1 February 2018	Researcher not present	0	0						October	955	780		
Friday, 2 February 2018	Researcher not present	0	0						November	950	800	<b>Total interview time</b>	31060
Monday, 5 February 2018	A,B,C,D	4	100						December	940	820	<b>Intervention study</b>	
Tuesday, 6 February 2018	E,F,H	3	100					<b>2019</b>	January	1030	680	Pre-intervention time	4050
Wednesday, 7 February 2018	I,M,N,O	4	120						February	945	710	Renovation period time	680
Thursday, 8 February 2018	Q,R,S	3	120						March	1010	650	Post intervention time	11375
Friday, 9 February 2018	T,U,V,W	4	120						April	800	780	<b>Developmental study</b>	
Saturday, 10 February 2018	J,K,L	3	100						May	845	570	Pre-occupancy time	6280
Monday, 12 February 2018	A,B,C,D	4	100						June	n/a	650	Post occupancy time	8675
Tuesday, 13 February 2018	F,G,H	3	100						July	n/a	750		
Wednesday, 14 February 2018	I,M,N	4	120						August	n/a	625		
Thursday, 15 February 2018	P,S	2	120						September	n/a	660		
Friday, 16 February 2018	T,U,V,W	4	110						October	n/a	595		
Monday, 19 February 2018	A,B,D	3	100						November	n/a	585		
Tuesday, 20 February 2018	E,F,G,H	4	100									<b>Total interview no</b>	1547
Wednesday, 21 February 2018	I,N,O	3	100									Intervention	
Thursday, 22 February 2018	P,Q,R,S	4	100									Pre-intervetion	160
Friday, 23 February 2018	T,U,V,W	2	100									Renovation	29
Saturday, 24 February 2018	J,K,L	3	100									post intrrvention	554
Monday, 26 February 2018	A,B,C,D	4	100										
Tuesday, 27 February 2018	F,G,H	3	100										
Wednesday, 28 February 2018	I,M,N,O	4	100	<b>880</b>	<b>1230</b>	<b>32</b>	<b>36</b>						

Thursday, 1 March 2018	3	80				
Friday, 2 March 2018	4	80				
Monday, 5 March 2018	3	60				
Tuesday, 6 March 2018	4	60				
Wednesday, 7 March 2018	4	70				
Thursday, 8 March 2018	3	70				
Friday, 9 March 2018	4	80				
Saturday, 10 March 2018	3	90				
Monday, 12 March 2018	4	60				
Tuesday, 13 March 2018	4	70				
Wednesday, 14 March 2018	2	70				
Thursday, 15 March 2018	4	70				
Friday, 16 March 2018	4	80				
Monday, 19 March 2018	3	60				
Tuesday, 20 March 2018	4	60				
Wednesday, 21 March 2018	4	70				
Thursday, 22 March 2018	3	70				
Friday, 23 March 2018	4	70				
Saturday, 24 March 2018	3	80				
Monday, 26 March 2018	4	60				
Tuesday, 27 March 2018	4	60				
Wednesday, 28 March 2018	3	70				
Thursday, 29 March 2018	4	70	<b>570</b>	<b>1040</b>	<b>34</b>	<b>48</b>

Predevelopmental	345
Post developmental	459
Total Interview time	31060
Pre-intervention time	4050
Renovation period time	680
Post intervention time	11375
Pre-occupancy time	6280
Post occupancy time	8675

## **Appendix – 20: Monthly Observations**

Date	Observations
January 22 2018	Upon prodding for views on 5S implementation, “Ahhh.. (silence) Its ok”
January 29 2018	While presenting the revised yearly plan, the training team presented no new ideas or market niches. Ideas were worn out, lacked creativity and appeared to be a half hearted attempt at best. Their body language was fatigued and dazed during discussions. While constructively critiquing resource allocation, they appeared numb and did not effectively defend their view points but for jittery mentioning “all ideas are taken”.
February 5 2018	While discussing quarterly market outlook, other departmental HOD’s suggest increased market potential for DSP - training participants appear demoralized and state, “ Well, it depends..(silence..pause) may be”
February 12 2018	Upon following up on the DSP suggestion, training participants had not reviewed the potential and looked worn –out. “ We need more time to understand DSP”.
February 19 2018	While other departments articulate human resource requirements to market needs, training team positions the need by mentioning, “we have more work and less people”.
February 26 2018	While discussing personnel productivity and work quantum forecast, the training team explained the on going assignment and foresaw no challenges. Clearly background work done was minimal.
March 5 2018	Upon enquiring on possible ways to increase revenue, training team members looked at each other and gave no meaningful action plan. Their body language looked defensive and resigned.
March 12 2018	The training team was silent while discussing project and customer feedbacks. When I prompted them for their views they said, “ The problem is different customers have different expectations. So it may be impossible to exceed customer expectations”

March 19 2018	While discussing, measures to improve delivery and feedback, there were no proposals from the training team, while the other teams looked at tweaking the key result areas after a root cause analysis.
March 26 2018	While discussing campus cleanliness, and general maintenance training team did not contribute. When a production colleague pointed to the vegetative overgrowth near the training building, there was no reaction for a few seconds. They then softly said, “ We have not seen”  When team members raise the concern of excessive boiler usage, the training team members murmured non-confidently, “ this is needed for our operations.”

Date	Instances
January 23 2018	When the training manager gave a background on 5S implementation, M voiced, “ We hardly have time. I am confused and there are too many things on the plate” P murmured, “ We have important deadlines this month...its not fair” Q added “ we have less staff, don’t we”. When the training HOD spoke about the yearly plan, there was a cacophony of different perspectives with team mates presenting operational issues. The tone of the conversation was defensive and looking to turn down new ideas fearing quantum of work. Reflecting the mood, J,K,L leading the meeting was also uninspiring with comment “ I fail to understand and you guys are exaggerating the time needed for work execution”.
January 30 2018	The brain storming session for market outlook was meaningless with no creative ideas coming to the fore. S, T, U, V, W sat next to each other and made occasional one line comments “ I don’t know”. N, O,P, R were on the edge , cold to each other and politely shooting down different suggestions. R discounted ideas saying “ Do you know the amount of work involved” P commented “ Do we have capabilities” N commented “ We are walking on thin air as always” O retorted “ People think and be practical. Surely its not that tough but yes its hard”
February 6 2018	Upon stating the need for a DSP module, there was panic and cross talking amongst members, with R stating nervously “ there is audit and XY client delivery, Oh my God “ When the Manager asked if anyone wanted to volunteer to lead the module, faces turned cold and quiet. J, K, L looked annoyed and grumbled “ What to do - Inefficient people we have”

February 13 2018	While discussing the work matrix, schedules and load factor, reluctance to expand the scope of work execution was obvious with M and N stating, “ We are delivering 1 module every week. Others need to work hard” At this Q, R voiced, “ please, we also have plenty to do” T,U,W nodded vociferously in agreement.
February 20 2018	J, k, L raise their voice upon seeing the project execution schedules, “ I thought you guys are better than this. It is shoddy work with no planning. Shameful”. R defends the delay and says, “ I couldn’t think and plan with project execution, audit and calibration.” S was visibly upset and mutters “There are too many things”.
February 27 2018	J expresses distress and laments, “Nothing on the DSP. The same modules again and again.. this is an excuse team. At this K, L reassures although forcibly, “ we will coordinate the efforts”.
March 6 2018	P, Q explore the market potential of DSP modules and report without any enthusiasm, “ it is niche but potential is there. But do we have the resolve, manpower and time to establish it”
March 13 2018	T, W lead the efforts to determine the possibilities for implementing the DSP course. They mention, “ If everything goes well, it will take at least 4,000 man hours and investments in fixed assets. So we think it is not worth the efforts.”
March 20 2018	Quarterly revenues are discussed. This was followed by silence. P then stated “ Don’t know, I think execution can be better” M stated “ execution is good but marketing needs to improve. Don’t blame just like that”. There was no consensus or unified action plan
March 27 2018	L appears irritated and roars, “punctuality is important. We are not pupils here. Be accountable”. This was in response to module delivery delays that were discussed.

## **Appendix – 21: Co-working**

**Aim:** To determine number of co-working days and time with study participants.

**Procedure:** Account of meetings and notes in the researcher journal (Appendix 20) were tabulated to determine co-working time in the study. This was then sorted according to months, types of meetings and co-working in the department.

**Result:** 433.50 hours of co-working time took place during the course of the study.

**Co-Working Days**

	<b>HOD Meeting</b>	<b>Training meeting</b>	<b>Training Co-working time</b>
Monday, 22 January 2018	1.00		
Tuesday, 23 January 2018		1.00	3.5
Monday, 29 January 2018	1.00		
Tuesday, 30 January 2018		1.00	4.0
Monday, 5 February 2018	1.00		
Tuesday, 6 February 2018		1.00	5.0
Monday, 12 February 2018	1.00		
Tuesday, 13 February 2018		1.00	7.0
Monday, 19 February 2018	1.00		
Tuesday, 20 February 2018		1.00	6.5
Monday, 26 February 2018	1.00		
Tuesday, 27 February 2018		1.00	4.0
Monday, 5 March 2018	1.00		
Tuesday, 6 March 2018		1.00	5.0
Monday, 12 March 2018	1.00		
Tuesday, 13 March 2018		1.00	3.0
Monday, 19 March 2018	1.00		
Tuesday, 20 March 2018		1.00	4.0
Monday, 26 March 2018	1.00		
Tuesday, 27 March 2018		1.00	3.0

**Monthly co-working**

	<b>Total Coworking time</b>	<b>HOD meetings</b>	<b>Training meetings</b>	<b>Training Co-working time</b>
<b>2018</b> January	11.50	2.00	2.0	7.5
February	30.50	4.00	4.00	22.5
March	23.00	4.00	4.00	15.0
April	28.00	5.00	4.00	19.0
May	26.25	4.00	4.25	18.0
June	28.50	4.25	4.75	19.5
July	30.50	5.00	5.00	20.5
August	23.00	4.00	4.00	15.0
September	24.00	4.00	4.00	16.0
October	32.00	5.00	5.00	22.0
November	24.00	4.00	4.00	16.0
December	20.00	5.00	4.00	11.0
<b>2019</b> January	28.75	4.25	4.50	20.0
February	22.50	4.00	4.00	14.5
March	23.50	4.00	4.00	15.5
April	31.50	5.00	5.00	21.5
May	26.00	4.00	4.00	18.0

<b><u>Total co-working time</u></b>	433.50 hrs
Pre-intervention	106.25
Renovation period	22.75
Post intervention	304.50

## **Appendix – 22: Observations**

**Aim:** To determine number of observations with study participants during the study period.

**Procedure:** Account of meetings and notes in the researcher journal (Appendix 5, Appendix 20 and Appendix 21) were further segregated into observations such as Duchenne smiles, workplace behaviors and non-participant behaviors.

**Result:** A total of 545 observations were noted during the study period..

**Study Observations**

	HOD Meeting	Training meeting	Co-working time	Observations on study participants	Duchenne Smiles	Workplace behaviors	Non-participant observations
Monday, 22 January 2018	1.00			3	1	2	
Tuesday, 23 January 2018		1.00	3.5	3	0	3	
Monday, 29 January 2018	1.00			2	1	1	
Tuesday, 30 January 2018		1.00	4.0	3	0	3	
Monday, 5 February 2018	1.00			3	0	3	
Tuesday, 6 February 2018		1.00	5.0	4	0	4	
Monday, 12 February 2018	1.00			4	0	4	
Tuesday, 13 February 2018		1.00	7.0	5	0	5	
Monday, 19 February 2018	1.00			3	0	3	
Tuesday, 20 February 2018		1.00	6.5	5	1	4	
Monday, 26 February 2018	1.00			4	1	3	
Tuesday, 27 February 2018		1.00	4.0	6	0	6	
Monday, 5 March 2018	1.00			5	0	5	
Tuesday, 6 March 2018		1.00	5.0	10	1	9	
Monday, 12 March 2018	1.00			4	0	4	
Tuesday, 13 March 2018		1.00	5.0	14	0	12	2
Monday, 19 March 2018	1.00			5	0	5	
Tuesday, 20 March 2018		1.00	4.0	12	0	11	1
Monday, 26 March 2018	1.00			7	0	7	
Tuesday, 27 March 2018		1.00	5.0	15	0	14	1

**Summary of study observations**

	Smiles	Behaviors	Non-partici	Observations
<b>Pre-intervention</b>				
<b>2018</b> January	2	9	0	11
February	2	32	0	34
March	1	67	4	72
April	3	28	0	31
May	1	16	0	17
<b>Renovation period</b>				
May	1	10	1	12
June	0	6	0	6
<b>Post-intervention</b>				
June	4	20	0	24
July	14	41	0	55
August	13	24	0	37
September	14	25	2	41
October	12	13	4	29
November	7	17	0	24
December	10	22	2	34
<b>2019</b> January	12	16	1	29
February	5	10	1	16
March	9	22	2	33
April	11	11	0	22
May	10	6	2	18

## References

- Abrahamse, W., Schultz, P.W. and Steg, L., 2016. Research designs for environmental issues. *Research methods for environmental psychology*, pp.53-70.
- Achari, R.V., 2016. From the Mythology of Vāstuśāstra to the Methodology of Vāstuvidyā. *Indian Journal of History of Science*, 51, pp.156-166.
- Adamczyk, P.D. and Bailey, B.P., 2004, April. If not now, when?: the effects of interruption at different moments within task execution. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 271-278). ACM.
- Adams, S.L. and Anantmula, V., 2010. Social and behavioral influences on team process. *Project Management Journal*,41(4), pp.89-98.
- Adelman, H.S. and Taylor, L.L., 1994. *On understanding intervention in psychology and education*. Westport, CT: Praeger.
- ADHIKARI, I.P., 2006. FengShui and Library Building: An introductory approach. *TULSSAA Journal*, 4(3), pp.5-10.
- Aguiler, J. L., 1981. Insider research: An ethnography of a debate. In D. A. Messerschmidt (Ed.), *Anthropologists at home in North America* (pp. 15-26). New York, NY: Cambridge University Press.
- Ahmed, V., Opoku, A. and Aziz, Z. eds., 2016. *Research methodology in the built environment: a selection of case studies*. Routledge.
- Akadiri, P.O., Chinyio, E.A. and Olomolaiye, P.O., 2012. Design of a sustainable building: A conceptual framework for implementing sustainability in the building sector. *Buildings*,2(2), pp.126-152.
- Akbari Chermahini, S. and Hommel, B., 2012. More creative through positive mood? Not everyone!. *Frontiers in Human Neuroscience*, 6, p.319.
- Aken, J.E.V., 2004. Management research based on the paradigm of the design sciences: the quest for field-tested and grounded technological rules. *Journal of management studies*,41(2), pp.219-246.
- Al Horr, Y., Arif, M., Kaushik, A., Mazroei, A., Katafygiotou, M. and Elsarrag, E., 2016. Occupant productivity and office indoor environment quality: A review of the literature. *Building and environment*, 105, pp.369-389.
- Alexander, C., 2002. *The phenomenon of life: An essay on the art of building and the nature of the universe*. Berkeley, CA: Center for Environmental Structure.
- Ali, M.M. and Moon, K.S., 2007. Structural developments in tall buildings: current trends and future prospects. *Architectural science review*, 50(3), pp.205-223.
- Alker, J., Malanca, M., Pottage, C. and O'Brien, R., 2014. *Health, wellbeing & productivity in offices: The next chapter for green building*. World Green Building Council.
- Alkin, M.C., Daillak, R., White, P. and White, P., 1979. *Using evaluations: does evaluation make a difference?* Beverly Hills: Sage, 1979 (Sage Library of Social Research Series, Vol. 76).
- Alksnis, E., 2011. Biological clock and the origin of life, *Biological Rhythm Research*,42:1, 1-3.
- Allen, T. J., & Henn, G. W., 2007. *The Organization and Architecture of Innovation: Managing the Flow of Technology*. Elsevier.
- Almatawa, M., Elmualim, A.A. and Essah, E.A., 2012. *Passive and active hybrid approach to building design in Saudi Arabia* (Doctoral dissertation, WIT Press).

- Almusaed, A., 2010. Biophilic and bioclimatic architecture: analytical therapy for the next generation of passive sustainable architecture. Springer Science & Business Media.
- Amabile, T.M. and Pratt, M.G., 2016. The dynamic componential model of creativity and innovation in organizations: Making progress, making meaning. *Research in Organizational Behavior*, 36, pp.157-183.
- Amabile, T.M., Barsade, S.G., Mueller, J.S. and Staw, B.M., 2005. Affect and creativity at work. *Administrative science quarterly*, 50(3), pp.367-403.
- Amaratunga, D., Baldry, D., Sarshar, M. and Newton, R., 2002. Quantitative and qualitative research in the built environment: application of "mixed" research approach. *Work study*, 51(1), pp.17-31.
- Amis, J.M. and Silk, M.L., 2008. The philosophy and politics of quality in qualitative organizational research. *Organizational Research Methods*, 11(3), pp.456-480.
- An, S., Ji, L.J., Marks, M. and Zhang, Z., 2017. Two sides of emotion: exploring positivity and negativity in six basic emotions across cultures. *Frontiers in psychology*, 8, p.610.
- Ananth, S., 1999. *The Penguin guide to Vaastu: The classical Indian science of architecture and design*. Penguin Books India.
- Ananth, S., 2001. *Vaastu: A path to harmonious living*. Roli Books.
- Andrade, J. and May, J., 2004. *BIOS instant notes in cognitive psychology*. Taylor & Francis.
- Annesley, T.M., 2010. The discussion section: your closing argument. *Clinical chemistry*, 56(11), pp.1671-1674.
- Anthes, Emily., 2009. How Room Designs Affect Your Work and Mood. [Online] <https://www.scientificamerican.com/article/building-around-the-mind/> [Accessed: 29 December, 2017]
- Aoun, RG., 2016. Emotional Design in Architecture: Impact of Space on Moods and Behaviour. Academy of Neuroscience for Architecture ANFA 2016 Conference.
- Appelbaum, S.H., Iaconi, G.D. and Matousek, A., 2007. Positive and negative deviant workplace behaviors: causes, impacts, and solutions. *Corporate Governance: The international journal of business in society*, 7(5), pp.586-598.
- Aram, J.D. and Salipante Jr, P.F., 2003. Bridging scholarship in management: Epistemological reflections. *British Journal of Management*, 14(3), pp.189-205.
- Aries, M.B., Veitch, J.A. and Newsham, G.R., 2010. Windows, view, and office characteristics predict physical and psychological discomfort. *Journal of Environmental Psychology*, 30(4), pp.533-541.
- Ariyachandra, T.R. and Frolick, M.N., 2008. Critical success factors in business performance management—Striving for success. *Information systems management*, 25(2), pp.113-120.
- Arya, R., 2000. *Vaastu: The Indian Art of Placement: Design and Decorate Homes to Reflect Eternal Spiritual Principles*. Inner Traditions/Bear & Co.
- Ashkanasy, N.M., Ayoko, O.B. and Jehn, K.A., 2014. Understanding the physical environment of work and employee behavior: An affective events perspective. *Journal of Organizational Behavior*, 35(8), pp.1169-1184.
- Attaianese, E., 2017. Ergonomics of Built Environment ie How Environmental Design Can Improve Human Performance and Well-Being in a Framework of Sustainability.
- Atwater, L. and Carmeli, A., 2009. Leader–member exchange, feelings of energy, and involvement in creative work. *The Leadership Quarterly*, 20(3), pp.264-275.

- Audrey, S. and Batista-Ferrer, H., 2015. Healthy urban environments for children and young people: a systematic review of intervention studies. *Health & Place*, 36, pp.97-117.
- Avenier, M.J. and Bartunek, J., 2010. Bridging a supposedly unbridgeable gap: elaborating scientific knowledge from and for practice.
- Avenier, M.J. and Cajaiba, A.P., 2012. The dialogical model: developing academic knowledge for and from practice. *European Management Review*, 9(4), pp.199-212.
- Avenier, M.J., 2009. A methodological framework for constructing generic knowledge with intended value both for academia and practice.
- Azmat, G. and Iriberry, N., 2010. The provision of relative performance feedback information: An experimental analysis of performance and happiness.
- Bachler, K. and Living, J.M., 2007. Earth radiation. Holistic Intuition Society.
- Bain, P. and Taylor, P., 2000. Entrapped by the 'electronic panopticon'? Worker resistance in the call centre. *New technology, work and employment*, 15(1), pp.2-18.
- Bajaj, V., 2011. For Wealthy Indian Family, Palatial House Is No Home. *New York Times*, 18.
- Bakker, A.B., 2009. Building engagement in the workplace. In R. J. Burke & C.L. Cooper (Eds.), *The peak performing organization* (pp. 50-72). Oxon, UK: Routledge.
- Balakumar, P., Inamdar, M.N. and Jagadeesh, G., 2013. The critical steps for successful research: The research proposal and scientific writing:(A report on the pre-conference workshop held in conjunction with the 64th annual conference of the Indian Pharmaceutical Congress-2012). *Journal of pharmacology & pharmacotherapeutics*, 4(2), p.130.
- Bandura, A., 1982. Self-efficacy mechanism in human agency. *American psychologist*, 37(2), p.122.
- Banerjee, S. and Morley, C., 2013. Professional doctorates in management: Toward a practice-based approach to doctoral education. *Academy of Management Learning & Education*, 12(2), pp.173-193.
- Banks, J.A., 1998. The lives and values of researchers: Implications for educating citizens in a multicultural society. *Educational Researcher*, 27(7), pp.4-17.
- Bar, M. and Neta, M., 2007. Visual elements of subjective preference modulate amygdala activation. *Neuropsychologia*, 45(10), pp.2191-2200.
- Barker, R.G., 1968. *Ecological psychology*. Stanford University Press.
- Barnard, H. and Pendock, C., 2013. To share or not to share: The role of affect in knowledge sharing by individuals in a diaspora. *Journal of International Management*, 19(1), pp.47-65.
- Baron, R.A. and Branscombe, N.R., 2009. *Social Psychology (Mumbai University)*, 12/E (With Cd). Pearson Education India.
- Baron, R.A., 1990. Environmentally induced positive affect: its impact on self-efficacy, task performance, negotiation, and conflict. *J. Appl. Soc. Psychol.*, 20, 368-384.
- Barratt, M., Choi, T.Y. and Li, M., 2011. Qualitative case studies in operations management: Trends, research outcomes, and future research implications. *Journal of Operations Management*, 29(4), pp.329-342.
- Barrett, L.F. and Bar, M., 2009. See it with feeling: affective predictions during object perception. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1521), pp.1325-1334.
- Barsade, S.G. and Gibson, D.E., 2007. Why does affect matter in organizations?. *Academy of management perspectives*, 21(1), pp.36-59.

- Barsade, S.G., 2000. The ripple effect: Emotional contagion in groups.
- Bar-Tal, D., Halperin, E. and De Rivera, J., 2007. Collective emotions in conflict situations: Societal implications. *Journal of Social Issues*, 63(2), pp.441-460.
- Bartel, C.A. and Saavedra, R., 2000. The collective construction of work group moods. *Administrative Science Quarterly*, 45(2), pp.197-231.
- Bassey, M., 1981. Pedagogic research: on the relative merits of search for generalisation and study of single events, *Oxford Review of Education* 7, 73–93.
- Bates, V., 2018. ‘Humanizing’ healthcare environments: architecture, art and design in modern hospitals. *Design for Health*, 2(1), pp.5-19.
- Batra, N., Sangwan, V. and Mehta, M., 2018. Vastu shastra: A tool for stress free living and empowering homemaker psychologically, physically and esthetically. *Indian Journal of Health and Wellbeing*, 9(3), pp.407-412.
- Baumeister, R.F. and Bushman, B., 2014. *Social psychology and human nature*, comprehensive edition. Belmont, CA: Cengage Learning.
- Bazeley, P., 2009. Analysing qualitative data: More than ‘identifying themes’. *Malaysian Journal of Qualitative Research*, 2(2), pp.6-22.
- Bechtel, R.B., 1997. *Environment and behavior: An introduction*. Sage Publications. Inc.
- Bechtel, R.B. and Churchman, A. eds., 2003. *Handbook of environmental psychology*. John Wiley & Sons.
- Becker, F.D. and Steele, F., 1995. *Workplace by design: Mapping the high-performance workscape*. Jossey-Bass.
- Beedie, C., Terry, P. and Lane, A., 2005. Distinctions between emotion and mood. *Cognition & Emotion*, 19(6), pp.847-878.
- Begemann, S.H.A., Van den Beld, G.J. and Tenner, A.D., 1997. Daylight, artificial light and people in an office environment, overview of visual and biological responses. *International Journal of Industrial Ergonomics*, 20(3), pp.231-239.
- Beil, K. and Hanes, D., 2013. The influence of urban natural and built environments on physiological and psychological measures of stress—A pilot study. *International journal of environmental research and public health*, 10(4), pp.1250-1267.
- Bell, J., 2005. *Doing your research project* (4th ed.). Maidenhead, England: Open University Press.
- Benton, J.S., Anderson, J., Hunter, R.F. and French, D.P., 2016. The effect of changing the built environment on physical activity: a quantitative review of the risk of bias in natural experiments. *International Journal of Behavioral Nutrition and Physical Activity*, 13(1), p.107.
- Berkes, F., Colding, J. and Folke, C., 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological applications*, 10(5), pp.1251-1262.
- Berry, L.L., Parker, D., Coile Jr, R.C. and Hamilton, D.K., 2004. The business case for better buildings. *Frontiers of health services management*, 21(1), p.3.
- Berto, R., 2005. Exposure to restorative environments helps restore attentional capacity. *Journal of environmental psychology*, 25(3), pp.249-259.
- Bhattacharya, T., 2009. *A Study on Vastuvidya or Canons of Indian Architecture*. United Press
- Bingham, C.B. and Eisenhardt, K.M., 2011. Rational heuristics: the ‘simple rules’ that strategists learn from process experience. *Strategic management journal*, 32(13), pp.1437-1464.

- Birkeland, J., 2012. Positive development: from vicious circles to virtuous cycles through built environment design. Routledge.
- Birtchnell, T., 2016. Vastu compliance: the gentrification of India's sacred spaces and the mobilities of ideas. *Journal of Ethnic and Migration Studies*, 42(14), pp.2345-2359.
- Bitner, M.J., 1992. Servicescapes: The impact of physical surroundings on customers and employees. *The Journal of Marketing*, pp.57-71.
- Bluyssen, P.M., 2014. What do we need to be able to (re) design healthy and comfortable indoor environments?. *Intelligent Buildings International*, 6(2), pp.69-92.
- Boaz, A. and Ashby, D., 2003. Fit for purpose? assessing research quality for evidence based policy and practice (pp. 1-55). London: ESRC UK Centre for Evidence Based Policy and Practice.
- Bolen, K.R., 2007. The Effect of Mood on Decision-making: A Role for Personal Experience (Doctoral dissertation, University of North Carolina Wilmington).
- Bolte, A., Goschke, T. and Kuhl, J., 2003. Emotion and intuition: Effects of positive and negative mood on implicit judgments of semantic coherence. *Psychological science*, 14(5), pp.416-421.
- Bond, M., 2017. The hidden ways that architecture affects how you feel [Online] <http://www.bbc.com/future/story/20170605-the-psychology-behind-your-citys-design> Accessed: 05 September, 2018
- Booth, A. and Carroll, C., 2015. How to build up the actionable knowledge base: the role of 'best fit' framework synthesis for studies of improvement in healthcare. *BMJ Qual Saf*, 24(11), pp.700-708.
- Boubekri, M., Hull, R.B. and Boyer, L.L., 1991. Impact of window size and sunlight penetration on office workers' mood and satisfaction: A novel way of assessing sunlight. *Environment and Behavior*, 23(4), pp.474-493.
- Boudreaux, M.J. and Ozer, D.J., 2013. Goal conflict, goal striving, and psychological well-being. *Motivation and Emotion*, 37(3), pp.433-443.
- Boulding, K.E., 1957. Organization and conflict. *Conflict Resolution*, 1(2), pp.122-134.
- Bourke, B., 2014. Positionality: Reflecting on the research process. *The Qualitative Report*, 19(33), pp.1-9.
- Bourner, T., Ruggeri-Stevens, G., Bareham, J. (2000) 'The DBA: Form and function', *Education and Training*, 42 (8/9), pp. 481-496.
- Bowen, G.A., 2005. Preparing a qualitative research-based dissertation: Lessons learned. *The qualitative report*, 10(2), pp.208-222.
- Bower, I., Tucker, R. and Enticott, P.G., 2019. Impact of built environment design on emotion measured via neurophysiological correlates and subjective indicators: A systematic review. *Journal of environmental psychology*, 66, p.101344.
- Bowling, A., 2014. *Research methods in health: investigating health and health services*. McGraw-Hill Education (UK).
- Boyce, P., Veitch, J.A., Newsham, G.R., Myer, M., Hunter, C., Heerwagen, J.H. and Jones, C.C., 2003. Lighting quality and office work: A field simulation study. *lighting research and technology*.
- Boyce, P.R., Beckstead, J.W., Eklund, N.H., Strobel, R.W. and Rea, M.S., 1997. Lighting the graveyard shift: The influence of a daylight-simulating skylight on the task performance and mood of night-shift workerst. *International journal of lighting research and technology*, 29(3), pp.105-134.
- Brand, S., 2012. Mood-Dependent Learning. *Encyclopedia of the Sciences of Learning*, pp.2330-2331.

- Braun, V. and Clarke, V., 2006. Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), pp.77-101.
- Brebner, J., 1982. *Environmental psychology in building design*. Elsevier Science Limited.
- Breen, L., 2007. The researcher'in the middle': Negotiating the insider/outsider dichotomy. *The Australian Community Psychologist*, 19(1), pp.163-174.
- Brekke, H., 2016. How does the built environment affect behaviour and cognition? In *Conscious Cities: Architecture and Neuroscience*, publication for conference in London, organized by The Cube and MoA.
- Brewer, J. and Hunter, A., 1989. *Multimethod research: a synthesis of styles*. Sage Publications, Inc.
- Brief, A. P., & Weiss, H. M., 2002. Organizational behavior: Affect in the workplace. *Annual Review of Psychology*, 53, 279–307.
- Brief, A.P. and Motowidlo, S.J., 1986. Prosocial organizational behaviors. *Academy of management Review*, 11(4), pp.710-725.
- Brill, M. and Weidemann, S., 2001. *Disproving widespread myths about workplace design*. Kimball International.
- Brill, M., Margulis, S.T. and Konar, E., 1985. *Using office design to increase productivity (Vol. 2). Workplace Design and Productivity*, Inc..
- Bringslimark, T., Hartig, T. and Patil, G.G., 2007. Psychological benefits of indoor plants in workplaces: Putting experimental results into context. *HortScience*, 42(3), pp.581-587.
- Brown, G., Lawrence, T.B. and Robinson, S.L., 2005. Territoriality in organizations. *Academy of Management Review*, 30(3), pp.577-594.
- Brown, L.A. and Roloff, M.E., 2011. Extra-role time, burnout, and commitment: The power of promises kept. *Business Communication Quarterly*, 74(4), pp.450-474.
- Browning, T.R., 2002. Process integration using the design structure matrix. *Systems Engineering*, 5(3), pp.180-193.
- Bruner, M.W., Boardley, I.D. and Côté, J., 2014. Social identity and prosocial and antisocial behavior in youth sport. *Psychology of sport and exercise*, 15(1), pp.56-64.
- Bryden, I., 2004. 'There is no outer without inner space': constructing the haveli as home. *cultural geographies*, 11(1), pp.26-41.
- Bunn, M., 2012 *Change your Desk Direction for peak performance!* [Online] <https://markbunn.com.au/blog/change-your-desk-direction-for-peak-performance> Accessed: 05 September, 2017
- Bunton, D., 2005. The structure of PhD conclusion chapters. *Journal of English for Academic Purposes*, 4(3), pp.207-224.
- Burnard, P., Gill, P., Stewart, K., Treasure, E. and Chadwick, B., 2008. Analysing and presenting qualitative data. *British dental journal*, 204(8), p.429.
- CABE, 2005. *The Impact of Office Design on Business Performance*.
- Cai, S. and Xu, Y., 2008. Voluntary knowledge sharing in organizations. *PACIS 2008 Proceedings*, p.59.
- Cairns, G., 2008. Advocating an ambivalent approach to theorizing the built environment. *Building Research & Information*, 36(3), pp.280-289.
- Callaway, H., 1992. Ethnography and experience. *Anthropology and autobiography*, 29, p.29.

- Cameron, D.S., Bertenshaw, E.J. and Sheeran, P., 2018. Positive affect and physical activity: Testing effects on goal setting, activation, prioritisation, and attainment. *Psychology & health*, 33(2), pp.258-274.
- Cameron, K. and Dutton, J. eds., 2003. *Positive organizational scholarship: Foundations of a new discipline*. Berrett-Koehler Publishers.
- Cameron, K., 2005. Organizational effectiveness: Its demise and re-emergence through positive organizational scholarship. *Great minds in management: The process of theory development*, pp.304-330.
- Cameron, K.S. and Caza, A., 2004. Contributions to the discipline of positive organizational scholarship. *American Behavioral Scientist*.
- Campbell, A., Converse, P.E. and Rodgers, W.L., 1976. *The quality of American life: Perceptions, evaluations, and satisfactions*. Russell Sage Foundation.
- Campbell, J.M., 1983. Ambient stressors. *Environment and behavior*, 15(3), pp.355-380.
- Campbell, J.P., McHenry, J.J. and Wise, L.L., 1990. Modeling job performance in a population of jobs. *Personnel Psychology*, 43(2), pp.313-575.
- Cane, J., O'Connor, D. and Michie, S., 2012. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation science*, 7(1), p.37.
- Canter, D.V., 1974. *Psychology for architects*. Applied Science.
- Capozzoli, T.K., 1995. Resolving conflict within teams. *The Journal for Quality and Participation*, 18(7), p.28.
- Carroll, C., Booth, A., Leaviss, J. and Rick, J., 2013. "Best fit" framework synthesis: refining the method. *BMC medical research methodology*, 13(1), p.37.
- Carson, D., Gilmore, A., Perry, C. and Gronhaug, K., 2001. *Qualitative marketing research*. Sage.
- Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J. and Neville, A.J., 2014, September. The use of triangulation in qualitative research. In *Oncology nursing forum* (Vol. 41, No. 5).
- Cassell, C. and Johnson, P., 2006. Action research: Explaining the diversity. *Human relations*, 59(6), pp.783-814.
- Cassidy, T., 2013. *Environmental psychology: Behaviour and experience in context*. Psychology Press.
- Chakrabarti, V., 2013. *Indian Architectural Theory and Practice: Contemporary Uses of Vastu Vidya*. Routledge.
- Chan, J.K., Beckman, S.L. and Lawrence, P.G., 2007. Workplace design: A new managerial imperative. *California Management Review*, 49(2), pp.6-22.
- Chan, T.C., Yen, T.J., Fu, Y.C. and Hwang, J.S., 2015. ClickDiary: Online Tracking of Health Behaviors and Mood. *Journal of medical Internet research*, 17(6).
- Chandrasekar, K., 2011. Workplace environment and its impact on organisational performance in public sector organisations. *International Journal of Enterprise Computing and Business Systems*, 1(1), pp.1-19.
- Charles, K.E., Danforth, A.J., Veitch, J.A., Zwierzchowski, C., Johnson, B. and Pero, K., 2004. *Workstation design for organizational productivity*. Ottawa: National Research Council of Canada.
- Chauhan, P.S., 2015. Get Your Office Vastu Right. [Online] <https://www.dailypioneer.com/2015/sunday-edition/get-your-office-vastu-right.html> Accessed: 03 August, 2019

- Chavez, C., 2008. Conceptualizing from the inside: Advantages, complications, and demands on insider positionality. *The Qualitative Report*, 13(3), pp.474-494.
- Chen, C.C. and Hennon, P., 1982. *Information seeking: assessing and anticipating user needs*. New York, NY: Neal-Schuman Publishers.
- Cheng, V. and Ng, E., 2006. Comfort temperatures for naturally ventilated buildings in Hong Kong. *Architectural Science Review*, 49(2), pp.179-182.
- Christopher, W.F., 2007. *Holistic management: managing what matters for company success (Vol. 46)*. John Wiley & Sons.
- Chughtai, H. and Myers, M.D., 2017. Entering the field in qualitative field research: A rite of passage into a complex practice world. *Information Systems Journal*, 27(6), pp.795-817.
- Chynoweth, P., 2013. *Practice-informed research : An alternative paradigm for scholastic enquiry in the built environment*. Property Management.
- Cianci, A.M. and Bierstaker, J.L., 2009. The impact of positive and negative mood on the hypothesis generation and ethical judgments of auditors. *Auditing: A Journal of Practice & Theory*, 28(2), pp.119-144.
- Clark, T., 2008. We're Over-Researched Here!' Exploring Accounts of Research Fatigue within Qualitative Research Engagements. *Sociology*, 42(5), pp.953-970.
- Clements-Croome, D. and Kaluarachchi, Y., 1998. An Assessment of the Influence of the Indoor Environment on the Productivity of Occupants in Offices. In *Proceedings of the IAQ Conference Design, Construction and Operation of Healthy Buildings*, Atlanta, GA, USA (pp. 588-593).
- Clements-Croome, D. ed., 2006. *Creating the productive workplace*. Taylor & Francis.
- Clements-Croome, D. ed., 2017. *Creating the Productive Workplace: Places to Work Creatively*. Taylor & Francis.
- Clements-Croome, D., 2000. *Creating The Productive Workplace*, D. Clements Croome, ed, London: E & FN Spon.
- Clements-Croome, D., 2003, September. Environmental quality and the productive workplace. In *CIBSE/ASHRAE Conference. Building Sustainability, Value and Profit*.
- Clements-Croome, D., 2015. Creative and productive workplaces: a review. *Intelligent Buildings International*, 7(4), pp.164-183.
- Clore, G.L. and Parrott, W.G., 1991. Moods and their vicissitudes: Thoughts and feelings as information. *Emotion and social judgments*, pp.107-123.
- Coburn, A., Vartanian, O. and Chatterjee, A., 2017. Buildings, Beauty, and the Brain: A Neuroscience of Architectural Experience. *Journal of Cognitive Neuroscience*.
- Coghill, C.L., Valaitis, R.K. and Eyles, J.D., 2015. Built environment interventions aimed at improving physical activity levels in rural Ontario health units: a descriptive qualitative study. *BMC public health*, 15(1), p.464.
- Coghlan, D. and Brannick, T., 2014. *Doing action research in your own organization*. Sage.
- Coghlan, D. and Shani, A.R., 2005. Roles, politics, and ethics in action research design. *Systemic Practice and Action Research*, 18(6), pp.533-546.
- Coghlan, D., 2019. *Doing action research in your own organization*. SAGE Publications Limited.
- Cole, M.S., Bruch, H. and Vogel, B., 2012. Energy at work: A measurement validation and linkage to unit effectiveness. *Journal of organizational Behavior*, 33(4), pp.445-467.

- Collins, B.L., 1993. Evaluation of subjective response to lighting distributions: a literature review. Building and Fire Research Laboratory, National Institute of Standards and Technology.
- Compte, O. and Postlewaite, A., 2004. Confidence-enhanced performance. *American Economic Review*, 94(5), pp.1536-1557.
- Concha Barrientos, M., Campbell-Lendrum, D. and Steenland, K., 2004. Assessing the burden of disease from work-related hearing impairment at national and local levels. *Environmental of Disease series*, no. 9. Geneva. World Health Organization.
- Cooper, R., & Burton, E. (2014). Wellbeing and the environmental implications for design. In *Wellbeing and the environment* (Vol. 2, pp. 653–668). West Sussex, England: John Wiley & Sons Inc.
- Corden, A. and Sainsbury, R., 2006. Using verbatim quotations in reporting qualitative social research: researchers' views (pp. 11-14). York: University of York.
- Corley, K.G. and Gioia, D.A., 2004. Identity ambiguity and change in the wake of a corporate spin-off. *Administrative science quarterly*, 49(2), pp.173-208.
- Côté, O., 2014. The intangible aspects of architectural spaces that influence human well-being. Permalink: <http://hdl.handle.net/1866/11897>
- Cottrell, S., 2017. *Critical thinking skills: Effective analysis, argument and reflection*. Macmillan International Higher Education.
- Coviello, D., Deserranno, E., Persico, N. and Sapienza, P., 2017. *Effect of Mood on Workplace Productivity*. mimeo.
- Craven, J., 2003. *The healthy home*. Quarry Books.
- Crawford, J.R. and Henry, J.D., 2004. The Positive and Negative Affect Schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *British journal of clinical psychology*, 43(3), pp.245-265.
- Creang, E., Ciotoiu, I., Gheorghiu, D. and Nash, G., 2010. Vernacular architecture as a model for contemporary design. *WIT Transactions on Ecology and the Environment*, 128, pp.157-171.
- Creswell, J. W., 2012. *Qualitative inquiry and research design: Choosing among five approaches*. Thousand Oaks, CA: Sage.
- Creswell, J.W. and Miller, D.L., 2000. Determining validity in qualitative inquiry. *Theory into practice*, 39(3), pp.124-130.
- Creswell, J.W. and Poth, C.N., 2017. *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.
- Cropanzano, R., Weiss, H.M., Hale, J.M. and Reb, J., 2003. The structure of affect: Reconsidering the relationship between negative and positive affectivity. *Journal of management*, 29(6), pp.831-857.
- Cross, R., Baker, W. and Parker, A., 2003. What creates energy in organizations?. *MIT Sloan Management Review*, 44(4), p.51.
- Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A. and Sheikh, A., 2011. The case study approach. *BMC medical research methodology*, 11(1), p.100.
- Cunningham, M.R., 1979. Weather, mood and helping behaviour. *J. Personality Soc. Psychol.* no. 37, 1947–1956.
- Cyfracki, L., 1990. Could upscale ventilation benefit occupants and owners alike. *Indoor Air*, 90(5), pp.135-141.
- Da Silva, S.G. ed., 2018. *New Interdisciplinary Landscapes in Morality and Emotion*. Routledge.

- Dalton, M. 1959. *Men who manage*. New York: Wiley as in Dyer, W.G. and Wilkins, A.L., 1991. Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt. *Academy of management review*, 16(3), pp.613-619.
- Danielsson, C., 2005. *Office environment, health and job satisfaction: an explorative study of office design's influence*(Doctoral dissertation, KTH).
- Das, P. and Rampuria, P., *Thinking spatial networks today*.
- Dasgupta, A., 2018. *Towards a unified framework for smart built environment design: an architectural perspective* (Doctoral dissertation, Virginia Tech).
- Dash, N. and Vasudev, G.D., 1998. *Vāstu, astrology, and architecture: papers presented at the First All India Symposium on Vāstu, Bangalore, held on June 3-4, 1995*. Motilal Banarsidass Publ.
- Davern, M.T., Cummins, R.A. and Stokes, M.A., 2007. Subjective wellbeing as an affective-cognitive construct. *Journal of Happiness Studies*, 8(4), pp.429-449.
- Davis MC, Leach DJ, Clegg CW. 2011. The physical environment of the office: contemporary and emerging issues. *International Review of Industrial and Organizational Psychology 2011*: 193–237. DOI: 10.1002/9781119992592.ch6
- Day, C. and Rose, G., 2004. Places of the soul: Architecture and Environmental Design as a Healing Art. *Environments*,32(3), p.115.
- De Choudhury, M. and Counts, S., 2013, February. Understanding affect in the workplace via social media. In *Proceedings of the 2013 conference on Computer supported cooperative work* (pp. 303-316). ACM.
- De Ruyter, K. and Scholl, N., 1998. Positioning qualitative market research: reflections from theory and practice. *Qualitative market research: An international journal*, 1(1), pp.7-14.
- DeKay, M. and Brown, G.Z., 2013. *Sun, wind, and light: architectural design strategies*. John Wiley & Sons.
- Dekker, S.W. and Woods, D.D., 1999. To intervene or not to intervene: The dilemma of management by exception. *Cognition, Technology & Work*, 1(2), pp.86-96.
- DeLancey, C., 2006. Basic moods. *Philosophical Psychology*,19(4), pp.527-538.
- DeLyser, D., 2001. 'Do you really live here?' Thoughts on insider research. *Geographical Review*, 91(1/2), 441-453.
- Denscombe, M., 1998. *The good research guide for small-scale social research projects*, Buckingham: Open University Press.
- Denyer, D., Tranfield, D. and Van Aken, J.E., 2008. Developing design propositions through research synthesis. *Organization studies*, 29(3), pp.393-413.
- Denzin, N.K. and Lincoln, Y.S. eds., 2011. *The Sage handbook of qualitative research*. Sage.
- Dervin, B., 1977. *The Development of Strategies for Dealing with the Information Needs of Urban Residents: Phase II--Information Practitioner Study*.
- Desmet, P.M., 2015. Design for mood: Twenty activity-based opportunities to design for mood regulation. *International Journal of Design*, 9 (2), 2015.
- Diamond, K., 2003. *Feng Shui for Skeptics: Real solutions without superstition*. Four Pillars Publishing.
- Dingle, P., Tapsell, P. and Hu, S., 2000. Reducing formaldehyde exposure in office environments using plants. *Bulletin of environmental contamination and toxicology*, 64(2), pp.302-308.

- Dix, D.M., 2017. The Relationship between Coping Strategies and Burnout for Caregivers of Adjudicated Youth.
- Doolin, B., 1998. Information technology as disciplinary technology: being critical in interpretive research on information systems. *Journal of Information Technology*, 13(4), pp.301-311.
- Dorgan, C.E., 1994. productivity Link to the Indoor Environment Estimated Relative to ASHRAE 62-1989 Proceedings of Health Buildings '94, Budapest, pp.461-472.
- Drake, P., 1990. Summary of findings from the advanced office design impact assessments. Report to Johnson Controls, Inc.
- Drake, P., 2010. Grasping at methodological understanding: a cautionary tale from insider research. *International Journal of Research & Method in Education*, 33(1), pp.85-99.
- Drapeau, C.W., 2010. Creativity and Positive Affect: Is High Creativity Dependent on an Elevated Mood?. *IU South Bend Undergraduate Research Journal*, 10, pp.83-90.
- Du Toit, J.L. and Mouton, J., 2013. A typology of designs for social research in the built environment. *International Journal of Social Research Methodology*, 16(2), pp.125-139.
- Duffy, F., 2000. Design and facilities management in a time of change. *Facilities*, 18(10/11/12), pp.371-375.
- Duffy, F., 2014. Justifying place in a virtual world. *Connected Real Estate: ESSAYS from Innovators in Real Estate, Design, and Construction*.
- Duque, M.J., Turla, C. and Evangelista, L., 2013. Effects of emotional state on decision making time. *Procedia-Social and Behavioral Sciences*, 97, pp.137-146.
- Dutton, J.E. and Ragins, B.R., 2017. Exploring positive relationships at work: Building a theoretical and research foundation. Psychology Press.
- Dutton, J.E., 2006. Energize your workplace: How to create and sustain high-quality connections at work. John Wiley & Sons.
- Dvir, D. and Shenhar, A., 1992. Measuring the success of technology-based strategic business units. *Engineering Management Journal*, 4(4), pp.33-38.
- Dwyer, S.C. and Buckle, J.L., 2009. The space between: On being an insider-outsider in qualitative research. *International journal of qualitative methods*, 8(1), pp.54-63.
- Dyer, W.G. and Wilkins, A.L., 1991. Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt. *Academy of management review*, 16(3), pp.613-619.
- Earle, H.A., 2003. Building a workplace of choice: Using the work environment to attract and retain top talent. *Journal of Facilities Management*, 2(3), pp.244-257.
- Eberhard, J.P., 2009. Brain landscape the coexistence of neuroscience and architecture. Oxford University Press.
- Eberhard, J.P., 2009a. Applying neuroscience to architecture. *Neuron*, 62(6), pp.753-756.
- Eckerson, W.W., 2010. Performance dashboards: measuring, monitoring, and managing your business. John Wiley & Sons.
- Edmondson, A.C. and McManus, S.E., 2007. Methodological fit in management field research. *Academy of management review*, 32(4), pp.1246-1264.
- Edosomwan, J., 1995. Integrating productivity and quality management. CRC Press.
- Ekkekakis, P., 2012. Affect, mood, and emotion. *Measurement in sport and exercise psychology*, 321.

- Ekkekakis, P., 2013. The measurement of affect, mood, and emotion: A guide for health-behavioral research. Cambridge University Press.
- Ekman, P., 1972. Universals and cultural differences in facial expression of emotions, in J.R. Cole (ed.) Nebraska Symposium on Motivation. Lincoln, NE: University of Nebraska Press.
- Ekman, P., 1994. Moods, emotions, and traits. The nature of emotion: Fundamental questions, pp.56-58.
- Elbaiuomy, E., Hegazy, I. and Sheta, S., 2017. The impact of architectural spaces' geometric forms and construction materials on the users' brainwaves and consciousness status. International Journal of Low-Carbon Technologies, 13(1), pp.43-51.
- Eldh, A.C. and Wallin, L., 2015. How Single Is "Single"-Some Pragmatic Reflections on Single Versus Multifaceted Interventions to Facilitate Implementation: Comment on "Translating Evidence Into Healthcare Policy and Practice: Single Versus Multifaceted Implementation Strategies—Is There a Simple Answer to a Complex Question?". International journal of health policy and management, 4(10), p.699.
- Elfenbein, H.A., 2014. The many faces of emotional contagion: An affective process theory of affective linkage. Organizational Psychology Review, 4(4), pp.326-362.
- Eliopoulos, G.M., Harris, A.D., Bradham, D.D., Baumgarten, M., Zuckerman, I.H., Fink, J.C. and Perencevich, E.N., 2004. The use and interpretation of quasi-experimental studies in infectious diseases. Clinical infectious diseases, 38(11), pp.1586-1591.
- Ellemers, N., Sleebos, E., Stam, D. and de Gilder, D., 2013. Feeling included and valued: How perceived respect affects positive team identity and willingness to invest in the team. British Journal of Management, 24(1), pp.21-37.
- Ellis, E.V., 2005. Squaring the circle: The regulating lines of Claude Bragdon's Theosophic architecture. Virginia Polytechnic Institute and State University.
- Ellis, T.J. and Levy, Y., 2008. Framework of problem-based research: A guide for novice researchers on the development of a research-worthy problem. Informing Science, 11.
- Elsbach, K. D., & Pratt, M. G. (2007). Chapter 4: The Physical Environment in Organizations. The Academy of Management Annals, 1(1), 181-224.
- El-Zeiny, R.M.A., 2012. The interior design of workplace and its impact on employees' performance: A case study of the private sector corporations in Egypt. Procedia-Social and Behavioral Sciences, 35, pp.746-756.
- Erlanson, D.A., Harris, E.L., Skipper, B.L. and Allen, S.D., 1993. *Doing naturalistic inquiry: A guide to methods*. Sage.
- Erlichman, H. and Bastone, L. (1991) Odour Experience as an Affective State, Report to the Fragrance Research Fund, New York, in Clements-Croome, D., 2000. Creating The Productive Workplace, D. Clements Croome, ed, London: E & FN Spon.
- Essawy, S., Kamel, B. and Elsayy, M.S., 2014. TIMELESS BUILDINGS AND THE HUMAN BRAIN: The Effect of Spiritual Spaces on Human Brain Waves. ArchNet-IJAR, 8(1).
- Esteky, S., 2017. Architecture of Choice: Exploring the Impact of Built Environments on Consumer Behavior (Doctoral dissertation).
- Evans, G.W. and McCoy, J.M., 1998. When buildings don't work: The role of architecture in human health. Journal of Environmental psychology, 18(1), pp.85-94.
- Evered, R. and Louis, M.R., 1981. Alternative perspectives in the organizational sciences: "inquiry from the inside" and "inquiry from the outside". Academy of management review, 6(3), pp.385-395.

- Farhana, Z., Ali, S.M. and Rahman, M., 2011. Investigation on workplace environment and safety—a case study in Rahimafrooz Batteries Ltd. *International Journal of Quality and Innovation*, 1(4), pp.338-347.
- Farr, J.L. and West, M.A. eds., 1990. *Innovation and creativity at work: Psychological and organizational strategies*. Wiley.
- Fathy, H., 1986. *Natural energy and vernacular architecture*. United States: N.P.
- Fazeli, H. and Goodarzi, A., 2010. The principles of Vastu as a traditional architectural belief system from an environmental perspective. *WIT Transactions on Ecology and the Environment*, 128, pp.97-108.
- Feak, C.B. and Swales, J.M., 2011. *Creating contexts: Writing introductions across genres*. University of Michigan Press.
- Fernandez-Caballero, A., Martínez-Rodrigo, A., Pastor, J.M., Castillo, J.C., Lozano-Monazor, E., López, M.T., Zangróniz, R., Latorre, J.M. and Fernández-Sotos, A., 2016. Smart environment architecture for emotion detection and regulation. *Journal of biomedical informatics*, 64, pp.55-73.
- Fich, L.B., Gimmler, A., Petrini, L., Jelic, A., Djebbara, A.Z. and Jönsson, P., 2018. Does views to nature and the design of spaces matter?: A pain stress experiment. In *Academy of Neuroscience for Architecture 2018 Conference* (pp. 68-70).
- Finlay, C.C., Maus, S., Beggan, C.D., Bondar, T.N., Chambodut, A., Chernova, T.A., Chulliat, A., Golovkov, V.P., Hamilton, B., Hamoudi, M. and Holme, R., 2010. International geomagnetic reference field: the eleventh generation. *Geophysical Journal International*, 183(3), pp.1216-1230.
- Finnegan, M.J., Pickering, C.A. and Burge, P.S., 1984. The sick building syndrome: prevalence studies. *Br Med J (Clin Res Ed)*, 289(6458), pp.1573-1575.
- Firestone, W.A., 1993. Alternative arguments for generalizing from data as applied to qualitative research, *Educational Researcher* 22 16–23.
- Fisher, T., 2016. How Neuroscience Can Influence Architecture. *The Journal of the American Institute of Architects* quoting the study in
- Fitzgerald, C.J. and Danner, K.M., 2012. Evolution in the office: How evolutionary psychology can increase employee health, happiness, and productivity. *Evolutionary Psychology*, 10(5), 147470491201000502.
- Fleck, S.E., 2009. International comparisons of hours worked: an assessment of the statistics. *Monthly Lab. Rev.*, 132, p.3.
- Flick, U., 2014. *An introduction to qualitative research*. Sage.
- Flink, I.K., Peters, M.L., Bergbom, S., Bergman, M., Ekstrand, K., Carstens, J.K. and Tillfors, M., 2018. Dwelling on a Successful Task: Does How or Why Influence Affect?. *Journal of Experimental Psychopathology*, 9(3), pp.jep-047915.
- Florio-Ruane, S., 1991. Conversation and narrative in collaborative research, in: *Stories lives tell: narrative and dialogue in education*, C. Witherell and N. Noddings, eds, New York: Teachers College Press, pp. 234–256.
- Foote, M.Q. and Bartell, T.G., 2011. Pathways to equity in mathematics education: How life experiences impact researcher positionality. *Educational Studies in Mathematics*, 78(1), pp.45-68.
- Fredrickson, B.L., 2001. The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American psychologist*, 56(3), p.218.
- Frijda, N.H., 2009. Emotion experience and its varieties. *Emotion Review*, 1(3), pp.264-271.

- Fross, K. and Sempruch, A., 2015. The qualitative research for the architectural design and evaluation of completed buildings. Part 2—examples of accomplished research. *Architecture Civil Engineering Environment*, 8.
- Frumkin, H., 2003. Healthy places: exploring the evidence. *American journal of public health*, 93(9), pp.1451-1456.
- Galasiu, A.D. and Veitch, J.A., 2006. Occupant preferences and satisfaction with the luminous environment and control systems in daylit offices: a literature review. *Energy and Buildings*, 38(7), pp.728-742.
- Galindo Galindo, M.P. and Corraliza Rodríguez, J.A., 2000. Environmental aesthetics and psychological wellbeing: Relationships between preference judgements for urban landscapes and other relevant affective responses. *Psychology in Spain*, 4(1), pp.13-27.
- Gebel, K., Ding, D., Foster, C., Bauman, A.E. and Sallis, J.F., 2015. Improving current practice in reviews of the built environment and physical activity. *Sports Medicine*, 45(3), pp.297-302.
- Gebizli, C.S., Sözer, H. and Ercan, A.Ö., 2016, April. Successive refinement of models for model-based testing to increase system test effectiveness. In 2016 IEEE Ninth International Conference on Software Testing, Verification and Validation Workshops (ICSTW) (pp. 263-268). IEEE.
- Gebken, R.J., Bruce, R.D. and Strong, S.D., 2009. Impact of the leadership in energy and environmental design accredited professional credential on design professionals. *Journal of Professional Issues in Engineering Education and Practice*, 136(3), pp.132-138.
- Gendolla, G.H., Brinkmann, K. and Richter, M., 2007. Mood, motivation, and performance: An integrative theory, research, and applications. *Mood and human performance: Conceptual, measurement, and applied issues*, pp.35-61.
- George, J.M., 1991. State or trait: Effects of positive mood on prosocial behaviors at work. *Journal of applied Psychology*, 76(2), p.299.
- George, J.M., 1992. Extrinsic and intrinsic origins of perceived social loafing in organizations. *Academy of Management Journal*, 35(1), pp.191-202.
- George, J.M., 2000. Emotions and leadership: The role of emotional intelligence. *Human relations*, 53(8), pp.1027-1055.
- Gervais, M. and Wilson, D.S., 2005. The evolution and functions of laughter and humor: A synthetic approach. *The Quarterly review of biology*, 80(4), pp.395-430.
- Gibbs, G.R., 2007. *Thematic coding and categorizing. Analyzing qualitative data*. London: Sage, pp.38-56.
- Gibson, D.E. and Callister, R.R., 2010. Anger in organizations: Review and integration. *Journal of management*, 36(1), pp.66-93.
- Gifford, R., 2014. Environmental psychology matters. *Annual review of psychology*, 65, pp.541-579.
- Gilbert, D., 2012. The science behind the smile. Interview by Gardiner Morse. *Harvard business review*, 90(1-2), 84-8.
- Giles, G.E., Mahoney, C.R., Brunyé, T.T., Taylor, H.A. and Kanarek, R.B., 2014. Stress effects on mood, HPA axis, and autonomic response: comparison of three psychosocial stress paradigms. *PLoS one*, 9(12), p.e113618.
- Gillis, K. and Gatersleben, B., 2015. A review of psychological literature on the health and wellbeing benefits of biophilic design. *Buildings*, 5(3), pp.948-963.

- Gioia, D.A., Corley, K.G. and Hamilton, A.L., 2013. Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational research methods*, 16(1), pp.15-31.
- Gioia, D.A., Price, K.N., Hamilton, A.L. and Thomas, J.B., 2010. Forging an identity: An insider-outsider study of processes involved in the formation of organizational identity. *Administrative science quarterly*, 55(1), pp.1-46.
- Gist, M.E. and Mitchell, T.R., 1992. Self-efficacy: A theoretical analysis of its determinants and malleability. *Academy of Management review*, 17(2), pp.183-211.
- Gitlin, L.N., 2013. Introducing a new intervention: An overview of research phases and common challenges. *American Journal of Occupational Therapy*, 67(2), pp.177-184.
- Given, L.M. ed., 2008. *The Sage encyclopedia of qualitative research methods*. Sage Publications
- Gizir, S. and Simsek, H., 2005. Communication in an academic context. *Higher Education*, 50(2), pp.197-221.
- Gnyawali, D.R. and Song, Y., 2016. Pursuit of rigor in research: Illustration from coopetition literature. *Industrial Marketing Management*, 57, pp.12-22.
- Golafshani, N., 2003. Understanding reliability and validity in qualitative research. *The qualitative report*, 8(4), pp.597-606.
- Goldenberg, L. and Forgas, J.P., 2012. Can happy mood reduce the just world bias? Affective influences on blaming the victim. *Journal of Experimental Social Psychology*, 48(1), pp.239-243.
- Golding, C., 2017. Advice for writing a thesis (based on what examiners do). *Open Review of Educational Research*, 4(1), pp.46-60.
- Goodarzi, A. and Fazeli, H., 2014. Identifying the principles of traditional Iranian architecture in the light of Vastu Shastra, the traditional Indian wisdom. *Journal of Design and Built Environment*, 14(1).
- Gough, D., Oliver, S. and Thomas, J. eds., 2017. *An introduction to systematic reviews*. Sage.
- Graham, L. T., Gosling, S. D., & Travis, C. K. (2015). The psychology of home environments: A call for research on residential space. *Perspectives on Psychological Science*, 10, 346–356.
- Grandy, J., 1996. Differences in the survey responses of Asian American and White science and engineering students. *ETS Research Report Series*, 1996(2), pp.i-23.
- Gray, J.M. and Tippett, H., 1992. *Office Space: A primer for managers*. Centre for Building Performance Research.
- Greene, M.J., 2014. On the inside looking in: Methodological insights and challenges in conducting qualitative insider research. *The qualitative report*, 19(29), pp.1-13.
- Greenwood, D.J. and Levin, M., 2007. *Introduction to action research*. 2nd ed. Thousand Oaks, California: SAGE publications.
- Guba, E.G. and Lincoln, Y.S., 1989. *Fourth generation evaluation*. Sage.
- Guba, E.G., 1981. ERIC/ECTJ Annual Review Paper. *Educational Communication and Technology*, 29(2), pp.75-91.
- Guest, G., MacQueen, K.M. and Namey, E.E., 2012. Validity and reliability (credibility and dependability) in qualitative research and data analysis. *Applied thematic analysis*. London: Sage Publications, pp.79-106.
- Gunay, H.B., O'Brien, W. and Beausoleil-Morrison, I., 2013. A critical review of observation studies, modeling, and simulation of adaptive occupant behaviors in offices. *Building and Environment*, 70, pp.31-47.

- Gundlach, M., Zivnuska, S. and Stoner, J., 2006. Understanding the relationship between individualism–collectivism and team performance through an integration of social identity theory and the social relations model. *Human relations*, 59(12), pp.1603-1632.
- Habib, J., 2010. An overview of some key researchers and topics in environment-behavior studies and some implications for architectural and environmental design (Doctoral dissertation, Kansas State University).
- Habraken, N.J., Mignucci, A. and Teicher, J., 2014. *Conversations with form: a workbook for students of architecture*. Routledge.
- Hacker, G.W., Eder, A., Augner, C. and Pauser, G., 2008. Geopathic stress zones and their influence on the human organism. In *Proceedings of the Druskininkai congress on 'Earth's Fields and Their Influence on Human Beings* (pp. 8-17).
- Hackman, J.R., 1980. Work redesign and motivation. *Professional Psychology*, 11(3), p.445.
- Haddon, J., 2018. The impact of employees' well-being on performance in the workplace. *Strategic HR Review*, 17(2), pp.72-75.
- Hale, G. and Evans, M., 2007. *Feng Shui: Mind & Body & Spirit & Home: Control and Enhance the Energies of Your House, Garden, and Inner Self by Understanding and Using Proven Ancient Techniques*. Hermes House.
- Hale, G., 2000. *Feng Shui for a Successful Office: How to create a harmonious working environment*. London: Southwater.
- Hall, S., Oldfield, P., Mullins, B.J., Pollard, B. and Criado-Perez, C., 2017. Evidence based practice for the built environment: Can systematic reviews close the research-practice gap?. *Procedia engineering*, 180, pp.912-924.
- Halpern, D., 2014. *Mental health and the built environment: more than bricks and mortar?*. Routledge.
- Hamel, G. and Prahalad, C.K., 1994. *Competing for the future* Harvard business school press. Boston, MA.
- Hamel, J., Dufour, S. and Fortin, D., 1993. *Case study methods* (Vol. 32). Sage.
- Hammer, O. and Von Stuckrad, K. eds., 2007. *Polemical encounters: esoteric discourse and its others* (Vol. 6). Brill.
- Handy, C., 2012. *The age of unreason*. Random House.
- Hari, A.R., 1995. *The Amazing Science of Vaastu*. AR Hari.
- Harrington, J.M., 1994. Shift work and health--a critical review of the literature on working hours. *Annals of the Academy of Medicine, Singapore*, 23(5), pp.699-705.
- Harter, J.K., Schmidt, F.L. and Keyes, C.L., 2003. Well-being in the workplace and its relationship to business outcomes: A review of the Gallup studies. *Flourishing: Positive psychology and the life well-lived*, 2, pp.205-224.
- Hartig, T., 2001 *Restorative Environments*. *Environment and Behavior*, 33 (Special Issue). Guest Editor's Introduction. Pp.475-479.
- Hartig, T., Evans, G.W., Jamner, L.D., Davis, D.S. and Gärling, T., 2003. Tracking restoration in natural and urban field settings. *Journal of environmental psychology*, 23(2), pp.109-123.
- Hartley, J.E., McAteer, J., Doi, L. and Jepson, R., 2019. CARE: The development of an intervention for kinship carers with teenage children. *Qualitative Social Work*, 18(6), pp.926-943.

- Hassell, D., 2018. Are the best leaders hands-off? Five secrets of effective managers. *Professional Safety*, 63(8), pp.24-25.
- Haviland-Jones, J., Rosario, H.H., Wilson, P. and McGuire, T.R., 2005. An environmental approach to positive emotion: Flowers. *Evolutionary Psychology*, 3(1), p.147470490500300109.
- Hay, A. and Samra-Fredericks, D., 2016. Desperately seeking fixedness: Practitioners' accounts of 'becoming doctoral researchers'. *Management learning*, 47(4), pp.407-423.
- Haynes, B. and Nunnington, N., 2010. *Corporate real estate asset management: Strategy and Implementation*. Published by Elsevier Ltd.
- Haynes, B., Nunnington, N. and Eccles, T., 2017. *Corporate real estate asset management: Strategy and Implementation*. Taylor & Francis.
- Hays, D.G., Wood, C., Dahl, H. and Kirk Jenkins, A., 2016. Methodological rigor in Journal of Counseling & Development qualitative research articles: A 15 year review. *Journal of Counseling & Development*, 94(2), pp.172-183.
- Heaton, D., 2016. Higher consciousness for sustainability-as-flourishing. In *Spirituality and Sustainability* (pp. 121-137). Springer International Publishing.
- Heckman, J.J. and Kautz, T., 2012. Hard evidence on soft skills. *Labour economics*, 19(4), pp.451-464.
- Hedge, A., 1986. Open vs. enclosed workspaces: The impact of design on employees' reactions to their offices. *Behavioral issues in office design*, pp.139-176.
- Hedge, A., Sims Jr, W.R. and Becker, F.D., 1995. Effects of lensed-indirect and parabolic lighting on the satisfaction, visual health, and productivity of office workers. *Ergonomics*, 38(2), pp.260-290.
- Heerwagen, J., 1998, May. Of light, time and space: Lighting quality and green building Design. In *InProceedings of the First CIE Symposium on Lighting Quality* (pp. 9-10).
- Heerwagen, J., 2000. Green buildings, organizational success and occupant productivity. *Building Research & Information*, 28(5-6), pp.353-367.
- Heerwagen, J.H. and Wise, J.A., 1998. Green building benefits: Differences in perceptions and experiences across manufacturing shifts. *Heating, piping and air conditioning*, 70(2).
- Heerwagen, J.H., 1990. Affective functioning, "light hunger," and room brightness preferences. *Environment and Behavior*, 22(5), pp.608-635.
- Helbich, M., 2018. Toward dynamic urban environmental exposure assessments in mental health research. *Environmental research*, 161, pp.129-135.
- Hemani, S. and Das, A.K., 2016. Humanising urban development in India: call for a more comprehensive approach to social sustainability in the urban policy and design context. *International Journal of Urban Sustainable Development*, 8(2), pp.144-173.
- Hematalikeikha, M.A., Coolen, H.C.C.H. and Pourdeihimi, S., 2014. Meaningful spatial and temporal sequences of activities in dwelling. In *Proceedings of New Researchers Colloquium ENHR 2014 Conference, Beyond Globalisation: Remaking Housing Policy in a Complex World*, Edinburgh (United Kingdom), 1-4 July, 2014; Authors version. ENHR.
- Hensen, J.L. and Lamberts, R. eds., 2012. *Building performance simulation for design and operation*. Routledge.
- Hernandez, S., 2010. *Eco-architecture III: Harmonisation Between Architecture and Nature* (Vol. 128). WIT Press.

- Herssens, J. and Heylighen, A., 2007, January. Haptic architecture becomes architectural hap. In *Ergonomics for a Future-Proceedings of the 39th Annual Conference of the Nordic Ergonomics Society-NES2007*. Nordic Ergonomic Society (NES).
- Herzberg, F., 2010. One more time. *How Do You Motivate Employees*, 4.
- Hewstone, M., Manstead, A.S.R. and Stroebe, W., 1997. *The Blackwell reader in social psychology*. Blackwell.
- Higuera-Trujillo, J.L., Llinares Millán, C., Montañana i Aviñó, A. and Rojas, J.C., 2019. Multisensory stress reduction: a neuro-architecture study of paediatric waiting rooms. *Building Research & Information*, pp.1-17.
- Hirt, E. R., Melton, R. J. McDonald, H. E., & Harackiewicz, J. M., 1996. Processing goals, task interest, and the mood–performance relationship: A mediation analysis. *Journal of Personality and Social Psychology*, 71, 245–261.
- Hogg, M.A., Abrams, D. and Martin, G.N., 2010. Social cognition and attitudes. *Psychology* (pp 646 - 677).
- Holcomb, L.C. and Pedelty, J.F., 1994. Comparison of employee upper respiratory absenteeism costs with costs associated with improved ventilation. *ASHRAE Transactions*,100(2), pp.914-921.
- Holmes, A., 2014. Researcher positionality: A consideration of its influence and place in research. *University of Hull*.
- House, E.R., 2005. Qualitative evaluation and changing social policy. *The Sage handbook of qualitative research*, 46, pp.1069-1081.
- Hox, J.J. and Boeije, H.R., 2005. Data collection, primary versus secondary.
- Hsieh, S. and Lin, S.J., 2019. The Dissociable Effects of Induced Positive and Negative Moods on Cognitive Flexibility. *Scientific reports*, 9(1), p.1126.
- Huang, Y.H., Robertson, M.M. and Chang, K.I., 2004. The role of environmental control on environmental satisfaction, communication, and psychological stress: Effects of office ergonomics training. *Environment and Behavior*, 36(5), pp.617-637.
- Huttunen, P., Hänninen, O. and Myllylä, R., 2011. Reported Curry and Hartmann Lines Probably Explained by Standing Radio Waves. In *5th European Conference of the International Federation for Medical and Biological Engineering* (pp. 929-932). Springer, Berlin, Heidelberg.
- Iaccarino, M., 2003. Science and culture: Western science could learn a thing or two from the way science is done in other cultures. *EMBO reports*, 4(3), pp.220-223.
- Ilgen, D.R., Hollenbeck, J.R., Johnson, M. and Jundt, D., 2005. Teams in organizations: From input-process-output models to IMOI models. *Annu. Rev. Psychol.*, 56, pp.517-543.
- Inam, A., 2002. Meaningful urban design: teleological/catalytic/relevant. *Journal of urban design*, 7(1),
- Ioannidis, J.P., 2007. Limitations are not properly acknowledged in the scientific literature. *Journal of clinical epidemiology*, 60(4), pp.324-329.
- Isen, A.M. and Levin, P.F., 1972. Effect of feeling good on helping: cookies and kindness. *Journal of personality and social psychology*, 21(3), p.384.
- Isen, A.M. and Shalker, T.E., 1982. The effect of feeling state on evaluation of positive, neutral, and negative stimuli: When you "accentuate the positive," do you "eliminate the negative"?. *Social psychology quarterly*.
- Isen, A.M., 1999. Positive affect. *Handbook of cognition and emotion*, 20, pp.522-539.

- Izen, A.M., Daubman, K.A. and Nowicki, G.P., 1987. Positive affect facilitates creative problem solving. *Journal of personality and social psychology*, 52(6), p.1122.
- Israel, T., 2003. *Some place like home: Using design psychology to create ideal places*. Chichester, England: Wiley-Academy.
- Issa, M.H., Rankin, J.H. and Christian, A.J., 2010. Canadian practitioners' perception of research work investigating the cost premiums, long-term costs and health and productivity benefits of green buildings. *Building and environment*, 45(7), pp.1698-1711.
- Izard, C.E., 1977. *Human Emotions*. London: Plenum.
- Jabareen, Y., 2009. Building a conceptual framework: philosophy, definitions, and procedure. *International journal of qualitative methods*, 8(4), pp.49-62.
- Jacelon, C.S. and Imperio, K., 2005. Participant diaries as a source of data in research with older adults. *Qualitative health research*, 15(7), pp.991-997.
- JACK, G. and BREWIS, J., 2005. Introducing organizational wellness. *Culture and Organization*, 11(2), pp.65-68.
- Janz, B.D., Colquitt, J.A. and Noe, R.A., 1997. Knowledge worker team effectiveness: The role of autonomy, interdependence, team development, and contextual support variables. *Personnel psychology*, 50(4), pp.877-904.
- Jensen, M.T., 2003. *Organizational communication: A review*. R&D Report, 1, p.2003.
- Jensen, P.A. and van der Voordt, T. eds., 2016. *Facilities management and corporate real estate management as value drivers: how to manage and measure adding value*. Taylor & Francis.
- Jester, T.C. ed., 2014. *Twentieth-century building materials: History and conservation*. Getty Publications.
- Jex, S.M. and Britt, T.W., 2014. *Organizational psychology: A scientist-practitioner approach*. John Wiley & Sons.
- Jhangiani, R.S., Chiang, I.A. and Price, P.C., 2015. *Research methods in psychology-2nd Canadian Edition*. BC Campus.
- Jiles, D., 2015. *Introduction to magnetism and magnetic materials*. CRC press.
- Johnson, M.D., Morgeson, F.P. and Hekman, D.R., 2012. Cognitive and affective identification: Exploring the links between different forms of social identification and personality with work attitudes and behavior. *Journal of Organizational Behavior*, 33(8), pp.1142-1167.
- Johnston, R.J., Gregory, D., Pratt, G. and Watts, M., 2000. *The Dictionary of Human Geography*, Oxford: Blackwell Publishers Ltd.
- Joshi, S.M., 2008. The sick building syndrome. *Indian journal of occupational and environmental medicine*, 12(2), p.61.
- Joye, Y., & Dewitte, S., 2016. Up speeds you down. Awe- evoking monumental buildings trigger behavioral and perceived freezing. *Journal of Environmental Psychology*, 47, 112–125.
- Joye, Y., 2007. Architectural lessons from environmental psychology: The case of biophilic architecture. *Review of General Psychology*, 11, 305–328.
- Judge, T.A. and Watanabe, S., 1993. Another look at the job satisfaction-life satisfaction relationship. *Journal of applied psychology*, 78(6), p.939.
- Jungert, T., Van den Broeck, A., Schreurs, B. and Osterman, U., 2018. How colleagues can support each other's needs and motivation: An intervention on employee work motivation. *Applied Psychology*, 67(1), pp.3-29.

- Kahn, W.A., 1990. Psychological conditions of personal engagement and disengagement at work. *Academy of management journal*, 33(4), pp.692-724.
- Kajikawa, Y., Inoue, T. and Goh, T.N., 2011. Analysis of building environment assessment frameworks and their implications for sustainability indicators. *Sustainability Science*, 6(2), pp.233-246.
- Kaklauskas, A., Abraham, A., Dzemyda, G., Raslanas, S., Seniut, M., Ubarte, I., Kurasova, O., Binkyte-Veliene, A. and Cerkauskas, J., 2020. Emotional, affective and biometrical states analytics of a built environment. *Engineering Applications of Artificial Intelligence*, 91, p.103621.
- Kaklauskas, A., Zavadskas, E.K., Bardauskiene, D., Cerkauskas, J., Ubarte, I., Seniut, M., Dzemyda, G., Kaklauskaite, M., Vinogradova, I. and Velykorusova, A., 2019. An Affect-Based Built Environment Video Analytics. *Automation in Construction*, 106, p.102888.
- Kämpfe, J., Sedlmeier, P. and Renkewitz, F., 2011. The impact of background music on adult listeners: A meta-analysis. *Psychology of Music*, 39(4), pp.424-448.
- Kannan, S. and Jani, V., 2010. Role of Vaastu in Contemporary Residential Design. *Design Principles & Practice: An International Journal*, 4(5).
- Kannan, S. and Jani, V., 2013. Revisiting Natural Energies: Vastu Shastra's Perspective for Sustainable Design. *The International Journal of Sustainability Policy and Practice*. Common Ground Publishing, University of Illinois Research Park.
- Kaplan, S., 1995. The restorative benefits of nature: Toward an integrative framework. *Journal of environmental psychology*, 15(3), pp.169-182.
- Karakas, T. and Yildiz, D., 2020. Exploring the influence of the built environment on human experience through a neuroscience approach: A systematic review. *Frontiers of Architectural Research*, 9(1), pp.236-247.
- Karandinou, A. and Turner, L., 2017. Architecture and neuroscience; what can the EEG recording of brain activity reveal about a walk through everyday spaces?. *International Journal of Parallel, Emergent and Distributed Systems*, 32(sup1), pp.S54-S65.
- Karanicolas, P.J., Farrokhyar, F. and Bhandari, M., 2010. Blinding: Who, what, when, why, how?. *Canadian journal of surgery*, 53(5), p.345.
- Karim I., 2010. *Back to a Future for Mankind*. CreateSpace Independent Publisher, Florida.
- Katsikakis, D. and Laing, A., 1993. *Assessment of Occupant Density Levels in Commercial Office Buildings*.
- Katz, D., 1964. The motivational basis of organizational behavior. *Behavioral science*, 9(2), pp.131-146.
- Kavanagh, D.J. and Bower, G.H., 1985. Mood and self-efficacy: Impact of joy and sadness on perceived capabilities. *Cognitive Therapy and Research*, 9(5), pp.507-525.
- Kavanagh, D.J., 1987. Mood, persistence, and success. *Australian Journal of Psychology*, 39(3), pp.307-318.
- Kawakami, M., Aoki, S. and Ohkubo, T., 1999. A study of "fragrance" on working environment characteristics in VDT work activities. *International journal of production economics*, 60, pp.575-581.
- Keedwell, P., 2009. *Architecture and Psychology in the 20th Century: Archetypes of human need and sanity*. History of Architecture: Double Dissertation.
- Keeling, T., Clements-Croome, D., Luck, R. and Pointer, P., 2012, April. How the sensory experience of buildings can contribute to wellbeing and productivity. In *Proceedings of the 7th Windsor*

Conference: The changing context of comfort in an unpredictable world. London: Network for Comfort and Energy Use in Buildings.

Kellert, S.R., 2012. Building for life: Designing and understanding the human-nature connection. Island press.

Kelly, J.R. and Barsade, S.G., 2001. Mood and emotions in small groups and work teams. *Organizational behavior and human decision processes*, 86(1), pp.99-130.

Kent, S. ed., 1993. Domestic architecture and the use of space: an interdisciplinary cross-cultural study. Cambridge University Press.

Keyes, C.L.M., 1998. Social well-being. *Social psychology quarterly*, pp.121-140.

Khosla, M., 2006. Positive affect and coping with stress. *Journal of the Indian Academy of Applied Psychology*, 32(3), pp.185-192.

Kiesler, S. and Cummings, J.N., 2002. What do we know about proximity and distance in work groups? A legacy of research. *Distributed work*, 1, pp.57-80.

Kilduff, M. and Mehra, A., 1997. Postmodernism and organizational research. *Academy of Management Review*, 22(2), pp.453-481.

Kim, H. and Kang, H., 2016. A study on development of a cost optimal and energy saving building model: Focused on industrial building. *Energies*, 9(3), p.181.

Kinjerski, V. and Skrypnik, B.J., 2008. The Promise of Spirit at Work Increasing Job Satisfaction and Organizational Commitment and Reducing Turnover and Absenteeism in Long-Term Care. *Journal of gerontological nursing*, 34(10), pp.17-25.

Klepeis, N.E., Nelson, W.C., Ott, W.R., Robinson, J.P., Tsang, A.M., Switzer, P., Behar, J.V., Hern, S.C. and Engelmann, W.H., 2001. The National Human Activity Pattern Survey (NHAPS): a resource for assessing exposure to environmental pollutants. *Journal of Exposure Science and Environmental Epidemiology*, 11(3), p.231.

Knez, I. and Hygge, S., 2002. Irrelevant speech and indoor lighting: effects on cognitive performance and self-reported affect. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, 16(6), pp.709-718.

Knez, I. and Kers, C., 2000. Effects of indoor lighting, gender, and age on mood and cognitive performance. *Environment and Behavior*, 32(6), pp.817-831.

Knight, A. and Ruddock, L. eds., 2009. *Advanced research methods in the built environment*. John Wiley & Sons.

Knight, C. and Haslam, S.A., 2010. Your place or mine? Organizational identification and comfort as mediators of relationships between the managerial control of workspace and employees' satisfaction and well-being. *British Journal of Management*, 21(3), pp.717-735.

Knight, R., 2014. Managing people from 5 generations. *Harvard Business Review*, 25(9), pp.1-7.

Kobal Grum, D., 2018. Interactions between human behaviour and the built environment in terms of facility management. *Facilities*, 36(1/2), pp.2-12.

Kodz, J., Davis, S., Lain, D., Strebler, M., Rick, J., Bates, P., Cummings, J., Meager, N., Anxo, D., Gineste, S. and Trinczek, R., 2003. Working long hours: a review of the evidence. Volume 1—Main report. *Employment Relations Research Series*, 16.

Kohen, D., Karklinsky, M., Meirovitch, Y., Flash, T. and Shmuelof, L., 2017. The effects of reducing preparation time on the execution of intentionally curved trajectories: optimization and geometrical analysis. *Frontiers in human neuroscience*, 11, p.333.

- Kohn, M.L. and Schooler, C., 1982. Job conditions and personality: A longitudinal assessment of their reciprocal effects. *American journal of Sociology*, 87(6), pp.1257-1286.
- Komulainen, E., Meskanen, K., Lipsanen, J., Lahti, J.M., Jylhä, P., Melartin, T., Wichers, M., Isometsä, E. and Ekelund, J., 2014. The effect of personality on daily life emotional processes. *PLoS One*, 9(10), p.e110907.
- Kopec, D.A., 2006. *Environmental psychology for design*. New York: Fairchild Books.
- Kopec, D. A., 2018. *Environmental Psychology for Design*. 317. New York: Bloomsbury Publishing Inc.
- Kovrigin, S.D. and Mikheyev, A.P., 1965. The effect of noise level on working efficiency. Joint Publications Research Service, Washington, DC Report No. N65-28297.
- Kraft, F.B. and Martin, C.L., 2001. Customer compliments as more than complementary feedback. *Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior*, 14, p.1.
- Krebs, D., 1982. Prosocial behavior, equity, and justice. In *Equity and justice in social behavior* (pp. 261-308). Academic Press.
- Krekel, C., Ward, G. and De Neve, J.E., 2019. Employee Wellbeing, Productivity, and Firm Performance. Saïd Business School WP, 4.
- Krishna, T., 2001. *The Vaastu Workbook: Using the subtle energies of the Indian Art of Placement to enhance health, prosperity, and happiness in your home*. Inner Traditions/Bear & Co.
- Krone, K.J., Jablin, F.M. and Putnam, L.L., 1987. Communication theory and organizational communication: Multiple perspectives. *Handbook of organizational communication: An interdisciplinary perspective*, 18(1), p.40.
- Kroner, W.M., 1994. Environmentally responsive workstations and office-worker productivity. *ASHRAE Transactions*, 100(2), pp.750-755.
- Kryter, K.D., 2013. *The effects of noise on man*. Elsevier.
- Kryžanowski, Š., 2015. Use of Environmental Psychology and Feng Shui for a More Supportive Living Environment. *South East European Journal of Architecture and Design*, 2015, pp.1-7.
- Kueller, R. and Mikellides, B., 1993. Simulated studies of color, arousal, and comfort. In *Environmental Simulation* (pp. 163-190). Springer, Boston, MA.
- Kuller, R. and Laike, T., 1998. The impact of flicker from fluorescent lighting on well-being, performance and physiological arousal. *Ergonomics*, 41(4), pp.433-447.
- Küller, R. and Wetterberg, L., 1993. Melatonin, cortisol, EEG, ECG and subjective comfort in healthy humans: impact of two fluorescent lamp types at two light intensities. *International Journal of Lighting Research and Technology*, 25(2), pp.71-80.
- Kumar, A., 2005. *Vaastu: The Art And Science Of Living*. Sterling Publishers Pvt. Ltd.
- Kumar, M., Jha, V. and Vaidya, S.D., 2007. Empirical investigation of impact of organizational culture, prosocial behavior and organizational trust on sharing mistakes in knowledge management systems. *PACIS 2007 Proceedings*, p.146.
- Kumar, R. ed., 2003. *Essays on Indian art and architecture*. Discovery Publishing House.
- Kumar, S., 2012. *Vastu for Home and Office*. Vij Books India Pvt Ltd.
- Kupritz, V.W., 2002. The relative impact of workplace design on training transfer. *Human resource development quarterly*, 13(4), pp.427-447.
- Kwallek, N., Soon, K. and Lewis, C.M., 2007. Work week productivity, visual complexity, and individual environmental sensitivity in three offices of different color interiors. *Color Research &*

Application: Endorsed by Inter-Society Color Council, The Colour Group (Great Britain), Canadian Society for Color, Color Science Association of Japan, Dutch Society for the Study of Color, The Swedish Colour Centre Foundation, Colour Society of Australia, Centre Français de la Couleur, 32(2), pp.130-143.

Kwallek, N., Soon, K., Woodson, H. and Alexander, J.L., 2005. Effect of color schemes and environmental sensitivity on job satisfaction and perceived performance. *Perceptual and motor skills*, 101(2), pp.473-486.

Kwallek, N., Woodson, H., Lewis, C.M. and Sales, C., 1997. Impact of three interior color schemes on worker mood and performance relative to individual environmental sensitivity. *Color Research & Application: Endorsed by Inter-Society Color Council, The Colour Group (Great Britain), Canadian Society for Color, Color Science Association of Japan, Dutch Society for the Study of Color, The Swedish Colour Centre Foundation, Colour Society of Australia, Centre Français de la Couleur*, 22(2), pp.121-132.

Kwantes, C.T., Idemudia, E.S. and Olasupo, M.O., 2018. Power Distance and Trustworthiness in Organizations: A Comparative Study of Students' Perceptions in Two Countries. *North American Journal of Psychology*, 20(2).

Labaree, R.V., 2009. *Research Guides: Organizing Your Social Sciences Research Paper: Qualitative Methods*.

Labaree, R.V., 2013. *Research Guides: Organizing your social sciences research paper: Qualitative Methods*.

Lacey, S.R., Cox, K.S., Lorfing, K.C., Teasley, S.L., Carroll, C.A. and Sexton, K., 2007. Nursing support, workload, and intent to stay in Magnet, Magnet-aspiring, and non-Magnet hospitals. *JONA: The Journal of Nursing Administration*, 37(4), pp.199-205.

Lagatree, K., 1997. Ancient Chinese wisdom for the modern workplace. *Training & Development*, 51(1), pp.26-30.

Lai, J.Y., Chi, H.J. and Yang, C.C., 2011. Task value, goal orientation, and employee job satisfaction in high-tech firms. *African Journal of Business Management*, 5(1), pp.76-87.

Laing, A., 2006. *New Patterns of Work: The Design of the Office*. In J. Worthington (Ed.), *Reinventing the Workplace* (2nd ed., pp. 29-49). Oxford: Architectural Press.

Larner, A.J. and Leach, J.P., 2002. Phineas Gage and the beginnings of neuropsychology. *Adv Clin Neurosci Rehabil*, 2(3), p.26.

Lawrence, D.L. and Low, S.M., 1990. The built environment and spatial form. *Annual review of anthropology*, 19(1), pp.453-505.

Lawrence, R.J., 1983. Architecture and behavioural research: A critical review. *Design Studies*, 4(2), pp.76-83.

Leaman, A. and Bordass, B., 1999. Productivity in buildings: the 'killer' variables. *Building Research & Information*, 27(1), pp.4-19.

Leather, P., Pyrgas, M., Beale, D. and Lawrence, C., 1998. Windows in the workplace: Sunlight, view, and occupational stress. *Environment and behavior*, 30(6), pp.739-762.

Leblebici, D., 2012. Impact of workplace quality on employee's productivity: case study of a bank in Turkey. *Journal of Business Economics and Finance*, 1(1), pp.38-49.

Leder, H., Oeberst, A., Augustin, D., & Belke, B. (2004). A model of aesthetic appreciation and aesthetic judgments. *British Journal of Psychology*, 95, 489–508.

- Lee, C. and Lee, H., 2015. Novelty-focussed document mapping to identify new service opportunities. *The Service Industries Journal*, 35(6), pp.345-361.
- Lee, J.W., Jones, P.S., Mineyama, Y. and Zhang, X.E., 2002. Cultural differences in responses to a Likert scale. *Research in nursing & health*, 25(4), pp.295-306.
- Lees-Haley, P.R., 1993. When sick building complaints arise...*Occupational health & safety (Waco, Tex.)*, 62(11), p.46.
- Leiter, M.P., 1991. Coping patterns as predictors of burnout: The function of control and escapist coping patterns. *Journal of Organizational behavior*, 12(2), pp.123-144.
- Leonardi, P.M., Treem, J.W. and Jackson, M.H., 2010. The connectivity paradox: Using technology to both decrease and increase perceptions of distance in distributed work arrangements. *Journal of Applied Communication Research*, 38(1), pp.85-105.
- Lerner, J.S., Li, Y., Valdesolo, P. and Kassam, K.S., 2015. Emotion and decision making. *Annual review of psychology*, 66, pp.799-823.
- Lerner, J.S., Small, D.A. and Loewenstein, G., 2004. Heart strings and purse strings: Carryover effects of emotions on economic decisions. *Psychological science*, 15(5), pp.337-341.
- Lesiuk, T., 2005. The effect of music listening on work performance. *Psychology of music*, 33(2), pp.173-191.
- Lewis, J., 2009. Redefining qualitative methods: Believability in the fifth moment. *International Journal of Qualitative Methods*, 8(2), pp.1-14.
- Li, H., Zhang, Y. and Li, F., 2017. Psychometric Properties of the Multi-Affect Indicator in a Chinese Worker Sample. *Psychological reports*, 120(1), pp.179-188.
- Li, J. and Lambert, V.A., 2008. Workplace stressors, coping, demographics and job satisfaction in Chinese intensive care nurses. *Nursing in critical care*, 13(1), pp.12-24.
- Li, L., Ai, H., Gao, L., Zhou, H., Liu, X., Zhang, Z., Sun, T. and Fan, L., 2017. Moderating effects of coping on work stress and job performance for nurses in tertiary hospitals: a cross-sectional survey in China. *BMC health services research*, 17(1), p.401.
- Lidwell, W., Holden, K. and Butler, J., 2010. *Universal principles of design, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design*. Rockport Pub.
- Likierman, Andrew., 2006. *Assessing the Effectiveness of Organisations: Is your Company Successful? Performance and Reward Centre Master Class*. Post meeting Notes. [http://faculty.london.edu/ALikierman/assets/documents/19a\\_Company\\_success\\_\(PARC\).pdf](http://faculty.london.edu/ALikierman/assets/documents/19a_Company_success_(PARC).pdf) Accessed: 2nd January 2018. Also see, *Measuring Company Success (Work in Progress)*. [http://faculty.london.edu/ALikierman/assets/documents/19\\_Company\\_success\\_\(PMA\).doc](http://faculty.london.edu/ALikierman/assets/documents/19_Company_success_(PMA).doc) Accessed: 2nd January 2018
- Lincoln, Y. S., 1995. 'Emerging criteria for quality in qualitative and interpretive research', *Qualitative Inquiry*, 1(3), pp. 275-289.
- Lo, S.M., Yiu, C.Y. and Lo, A., 2003. An analysis of attributes affecting urban open space design and their environmental implications. *Management of Environmental Quality: An International Journal*, 14(5), pp.604-614.
- Locke, K., 1996. A funny thing happened! The management of consumer emotions in service encounters. *Organization Science*, 7(1), pp.40-59.

- Lorsch, H.G. and Abdou, O.A., 1995. The impact of the building indoor environment on occupant productivity-Part 1-Recent studies, measures and costs. Part 2-Effects of temperature. Part 3-Effects of indoor air quality. In *Fuel and Energy Abstracts* (Vol. 4, No. 36, p. 294).
- Lowe, R., 2000. Defining and meeting the carbon constraints of the 21st century. *Building Research & Information*, 28(3), pp.159-175.
- Ludrup, J., 2013. *Feng Shui: Seeing is Believing: Essential Geomancy for Beginners and Skeptics*. Simon and Schuster.
- Lüscher, L.S. and Lewis, M.W., 2008. Organizational change and managerial sensemaking: Working through paradox. *Academy of management Journal*, 51(2), pp.221-240.
- Luthans, F., and Avolio, B. J., 2009. The “point” of positive organizational behavior. *Journal of Organizational Behavior*, 30, 291 – 307.
- Lykken, D. T., 2005. Mental energy. *Intelligence*, 33, 331–335.
- Macdonald, A.J., 2007. *Structure and architecture*. Routledge.
- Macomber, J.D. and James, G., 2010. *Design Creates Fortune: 2000 Tower Oakes Boulevard*. Harvard Business School Case 210-070
- Macphee, M., Wardrop, A. and Campbell, C., 2010. Transforming work place relationships through shared decision making. *Journal of Nursing Management*, 18(8), pp.1016-1026.
- Mahnke, F.H., 1996. *Color, environment, and human response*. Detroit: Van Nostrand Reinhold.
- Mak, M. Y., & Thomas Ng, S., 2005. The art and science of Feng Shui—A study on architects’ perception. *Building and Environment*, 40, 427–434.
- Malathouni, C., 2013. Architecture is the pattern of human mind in space: Claude F. Bragdon and the spatial concept of architecture. *The Journal of Architecture*, 18(4), pp.553-569.
- Mallgrave, H.F., 2013. *Architecture and embodiment: The implications of the new sciences and humanities for design*. Routledge.
- Maltz, A.C., Shenhar, A.J. and Reilly, R.R., 2003. Beyond the balanced scorecard:: Refining the search for organizational success measures. *Long range planning*, 36(2), pp.187-204.
- Marc, O., 1977. *Psychology of the House: With 111 Illustrations*. Thames and Hudson.
- Mariotti, A., 2015. The effects of chronic stress on health: new insights into the molecular mechanisms of brain–body communication. *Future science OA*, 1(3).
- Martin, E.A. and Kerns, J.G., 2011. The influence of positive mood on different aspects of cognitive control. *Cognition and Emotion*, 25(2), pp.265-279.
- Martin, L.L. and Clore, G.L., 2013. *Theories of mood and cognition: A user's guidebook*. Psychology Press.
- Martin, R., 2010. Design thinking: achieving insights via the “knowledge funnel”. *Strategy & Leadership*, 38(2), pp.37-41.
- Matthes, K., 1992. A Prescription for HEALTHIER OFFICES. *HR Focus*, 69(4), pp.4-5.
- Mauboussin, M.J., 2012. The true measures of success. *Harvard Business Review*, 90(10), pp.46-56.
- Maxwell, J.A., 2012. *Qualitative research design: An interactive approach* (Vol. 41). Sage publications.
- Mayer, J.D., Gaschke, Y.N., Braverman, D.L. and Evans, T.W., 1992. Mood-congruent judgment is a general effect. *Journal of personality and social psychology*, 63(1), p.119.

- Mazzocchi, F., 2006. Western science and traditional knowledge: Despite their variations, different forms of knowledge can learn from each other. *EMBO reports*, 7(5), pp.463-466.
- McCoy, J. M., 2005. Linking the Physical Work Environment to Creative Context. *The Journal of Creative Behavior*, 39(3),169-191.
- McCoy, J.M., 2001. The creative work environment: The relationship of the physical environment and creative teamwork at a state agency. A case study.
- McKenna, F.P. and Lewis, C., 1994. A speech rate measure of laboratory induced affect: the role of demand characteristics revisited. *British Journal of Clinical Psychology*, 33(3), pp.345-351.
- McLellan, G., 2017. Contemporary environmental colour design praxis in the urban context (Doctoral dissertation, Queensland University of Technology).
- McLellan, T.M., Caldwell, J.A. and Lieberman, H.R., 2016. A review of caffeine's effects on cognitive, physical and occupational performance. *Neuroscience & Biobehavioral Reviews*, 71, pp.294-312.
- McLendon, J. and Weinberg, G.M., 1996. Beyond blaming: congruence in large systems development projects. *IEEE Software*, 13(4), pp.33-42.
- Mehrabian, A. and Russell, J.R., 1974. *An Approach to Environmental Psychology*. MIT Press, Cambridge, MA.
- Menen, R., 2012. *Benefits of Vaastu & Feng Shui: The art of attracting health, wealth and happiness*. V&S Publishers.
- Menzies, D., Pasztor, J., Nunes, F., Leduc, J. and Chan, C.H., 1997. Effect of a new ventilation system on health and well-being of office workers. *Archives of Environmental Health: An International Journal*, 52(5), pp.360-367.
- Menzies, R., Tamblyn, R., Farant, J.P., Hanley, J., Nunes, F. and Tamblyn, R., 1993. The effect of varying levels of outdoor-air supply on the symptoms of sick building syndrome. *New England Journal of Medicine*, 328(12), pp.821-827.
- Meriam, S. B., 2002. *Introduction to Qualitative research*. USA : John Wiley & Sons.
- Merriam, S. A., Johnson-Bailey, J., Lee, M.-Y., Kee, Y., Ntseane, G., & Muhamad, M., 2001. Power and positionality: Negotiating insider/outsider status within and across cultures. *International Journal of Lifelong Education*, 20(5), 405-416.
- Merriam, S.B. and Tisdell, E.J., 2015. *Qualitative research: A guide to design and implementation*. John Wiley & Sons.
- Merriam, S.B., 1998. *Qualitative research and case study applications in education*, San Francisco: Jossey-Bass.
- Merton, R.K., 1972. Insiders and outsiders: A chapter in the sociology of knowledge. *American journal of sociology*, 78(1), pp.9-47.
- Metzger, C., 2018. *Neuroarchitecture*. Jovis Publications.
- Meyer, M. and Helfert, M., 2014. Evaluating Design Science Outputs–The Case of Enterprise Architecture Business Value Assessments. *Design Science: Perspectives from Europe*, p.135.
- Michie, S. and West, M.A., 2004. Managing people and performance: an evidence based framework applied to health service organizations. *International journal of management reviews*, 5(2), pp.91-111.
- Miles, M.B., Huberman, A.M. and Saldana, J., 2014. *Qualitative data analysis: A method sourcebook*. CA, US: Sage Publications.

- Miles, M.B., Huberman, A.M., 1994. *Qualitative data analysis: an expanded sourcebook*, 2nd ed. California: Sage.
- Mills, A.J., Durepos, G. and Wiebe, E. eds., 2010. *Encyclopedia of case study research: L-Z; index (Vol. 1)*. Sage.
- Mirela, B., 2018. The Effects Of Moods And Emotions On Decision Making Process—A Qualitative Study. *Annals of Faculty of Economics*, 1(1), pp.423-429.
- Mirka, G.A., Smith, C., Shivers, C. and Taylor, J., 2002. Ergonomic interventions for the furniture manufacturing industry. Part I—lift assist devices. *International Journal of Industrial Ergonomics*, 29(5), pp.263-273.
- Mishra, J., 1990. 'Managing the grapevine', *Public Personnel Management*, 19(2), pp. 213- 228.
- Mitchell, R. and Boyle, B., 2019. Inspirational leadership, positive mood, and team innovation: A moderated mediation investigation into the pivotal role of professional salience. *Human Resource Management*.
- Moffatt, S. and Kohler, N., 2008. Conceptualizing the built environment as a social–ecological system. *Building research & information*, 36(3), pp.248-268.
- Mohr, R., 1996. Office space is a revenue enhancer, not an expense. *National Real Estate Investor*, 38(7), pp.46-47.
- Molinsky, A., 2013. *Global dexterity: How to adapt your behavior across cultures without losing yourself in the process*. Harvard Business Review Press.
- Montes, C., Rodríguez, D. and Serrano, G., 2012. Affective choice of conflict management styles. *International Journal of Conflict Management*, 23(1), pp.6-18.
- Montgomery, J., Heubach, J., Weimer, W. and Heerwagen, J., 1994. Internal report, Impacts on satisfaction and productivity in a laboratory renovation. Pacific Northwest National Laboratory.
- Moore, T.H.M., Kesten, J.M., López-López, J.A., Ijaz, S., McAleenan, A., Richards, A., Gray, S., Savović, J. and Audrey, S., 2018. The effects of changes to the built environment on the mental health and well-being of adults: Systematic review. *Health & place*, 53, pp.237-257.
- Moossavi, S.M., 2016. *Vastu Shastra (Vedic Architecture)*.
- Morandi, A., Tosto, C., Sartori, G. and Roberti di Sarsina, P., 2011. Advent of a Link between Ayurveda and Modern Health Science: The Proceedings of the First International Congress on Ayurveda, "Ayurveda: The Meaning of Life—Awareness, Environment, and Health" March 21-22, 2009, Milan, Italy. *Evidence-Based Complementary and Alternative Medicine*, 2011.
- Morehouse, R.E. and Maykut, P., 2002. *Beginning qualitative research: A philosophical and practical guide*. Routledge.
- Moretz, S., 1988. Are your workers safe from sick building syndrome. *Occupational Hazards*, 50(2), pp.58-62.
- Morgan, B. and D’Mello, S., 2013, September. The Effect of Positive vs. Negative Emotion on Multitasking. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 57, No. 1, pp. 848-852)*. Sage CA: Los Angeles, CA: SAGE Publications.
- Morgan, G., 2011. Reflections on images of organization and its implications for organization and environment. *Organization & Environment*, 24(4), pp.459-478.
- Morrell, P. and Duffy, F., 2004. *The impact of office design on business performance*. Published by the Commission for Architecture & the Built Environment and the British Council for Offices.

- Morris, A. and Dennison, P., 1995. Sick building syndrome: survey findings of libraries in Great Britain. *Library management*, 16(3), pp.34-42.
- Moser, G. and Uzzell, D., 2003. Environmental psychology. *Handbook of psychology*, pp.419-445.
- Mouratidis, K., 2018. Rethinking how built environments influence subjective well-being: A new conceptual framework. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, 11(1), pp.24-40.
- Mowday, R.T., Porter, L.W. and Steers, R.M., 2013. Employee—organization linkages: The psychology of commitment, absenteeism, and turnover. Academic press.
- Mroczek, D.K. and Almeida, D.M., 2004. The effect of daily stress, personality, and age on daily negative affect. *Journal of personality*, 72(2), pp.355-378.
- Mumford, M.D., 2003. Where have we been, where are we going? Taking stock in creativity research. *Creativity research journal*, 15(2-3), pp.107-120.
- Murray, C.J. and Lopez, A.D., 1996. Evidence-based health policy--lessons from the Global Burden of Disease Study. *Science*, 274(5288), pp.740-743.
- Naess, P., 2016. Built environment, causality and urban planning. *Planning Theory & Practice*, 17(1), pp.52-71.
- Nagy, E., Yasunaga, S. and Kose, S., 1995. Japanese office employees' psychological reactions to their underground and above-ground offices. *Journal of environmental psychology*, 15(2), pp.123-134.
- Nanda, U., Pati, D., Ghamari, H. and Bajema, R., 2013. Lessons from neuroscience: form follows function, emotions follow form. *Intelligent Buildings International*, 5(sup1), pp.61-78.
- Naples, N.A., 2013. *Feminism and method: Ethnography, discourse analysis, and activist research*. Routledge.
- Nasar, J.L., 1981. Responses to different spatial configurations. *Human factors*, 23(4), pp.439-445.
- Nasar, Jack L., 2015. "Advances in Environmental Psychology." *Behav. Sci.* 5, no. 3: 384-387.
- National Research Council, 2006. Review and assessment of the health and productivity benefits of green schools: An interim report. National Academies Press.
- Nelson, D.W., 2016. Enhancing interpersonal communication: Positive mood effects. *Social Behavior and Personality: an international journal*, 44(9), pp.1535-1539.
- Nguyen, A.T., Truong, N.S.H., Rockwood, D. and Tran Le, A.D., 2019. Studies on sustainable features of vernacular architecture in different regions across the world: A comprehensive synthesis and evaluation. *Frontiers of Architectural Research*, 8 (4), 535–548.
- Nichols, A.L. and Maner, J.K., 2008. The good-subject effect: Investigating participant demand characteristics. *The Journal of general psychology*, 135(2), pp.151-166.
- Nicholson, N., 1977. Absence behaviour and attendance motivation: A conceptual synthesis. *Journal of Management Studies*, 14(3), pp.231-252.
- Nicol, J.F. and Kessler, M.R., 1998. Perception of comfort in relation to weather and indoor adaptive opportunities. *ASHRAE Transactions*, 104, p.1005.
- Norgaard, M., Ehrenstein, V. and Vandenbroucke, J.P., 2017. Confounding in observational studies based on large health care databases: problems and potential solutions—a primer for the clinician. *Clinical epidemiology*, 9, p.185.
- Northridge, M.E., Sclar, E.D. and Biswas, P., 2003. Sorting out the connections between the built environment and health: a conceptual framework for navigating pathways and planning healthy cities. *Journal of Urban Health*, 80(4), pp.556-568.

- Nunes, F., Menzies, R.I., Boehm, E. and Letz, R., 1993. The effect of varying levels of outdoor air supply on neurobehavioural function during a study of sick building syndrome. Jaakkola JJK, Ilmarinen R, Seppanen O, eds. *IndoorAir*.
- Nusbaum, A.T., Wilson, C.G., Stenson, A., Hinson, J.M. and Whitney, P., 2018. Induced Positive Mood and Cognitive Flexibility: Evidence from Task Switching and Reversal Learning. *Collabra: Psychology*, 4(1).
- Obata, G., 1987. Corporate Prestige Needn't Rely on Scraping the Sky. *Management Review*, 76(10), p.57.
- O'Connell, M. and Airey, R., 2005. *The illustrated encyclopedia of signs & symbols: identification and analysis of the visual vocabulary that formulates our thoughts and dictates our reactions to the world around us*. Lorenz Books.
- Ogden, J. and Cornwell, D., 2010. The role of topic, interviewee and question in predicting rich interview data in the field of health research. *Sociology of health & illness*, 32(7), pp.1059-1071.
- Oldham, G.R., 1988. Effects of changes in workspace partitions and spatial density on employee reactions: A quasi-experiment. *Journal of applied psychology*, 73(2), p.253.
- Oliver, P. ed., 1997. *Encyclopedia of vernacular architecture of the world (Vol. 3)*. Cambridge: Cambridge University Press.
- O'Neill, M. and Palmer, A., 2004. Cognitive dissonance and the stability of service quality perceptions. *Journal of Services Marketing*, 18(6), pp.433-449.
- Ong, A.D., Bergeman, C.S., Bisconti, T.L. and Wallace, K.A., 2006. Psychological resilience, positive emotions, and successful adaptation to stress in later life. *Journal of personality and social psychology*, 91(4), p.730.
- Organ, D.W., 1988. *Organizational citizenship behavior: The good soldier syndrome*. Lexington Books/DC Heath and Com.
- O'Rourke, S.M., 2017. *Designing Deeper: Creating Interior Spaces that Support Well-being Through Explorations in Process Driven Design* (Doctoral dissertation, University of North Carolina at Greensboro).
- Osterberg, A.E., Marie Davis, A. and Danielson, L.D., 1995. Universal design: the users' perspective. *Housing and Society*, 22(1-2), pp.92-113.
- Oswald, A.J., Proto, E. and Sgroi, D., 2015. Happiness and productivity. *Journal of Labor Economics*, 33(4), pp.789-822.
- Padam, J.P.A., 1998. *Vāstu: Reinventing the Architecture of Fulfillment*. Management Publishing Company.
- Pallasmaa, J., 2016. Inhabiting Time. *Architectural Design*, 86(1), pp.50-59.
- Pallasmaa, J., 2016. The Sixth Sense: The Meaning of Atmosphere and Mood. *Architectural Design*, 86(6), pp.126-133.
- Pandey, J.M., 2017. IIT Kharagpur to introduce Vastu Shastra [Online] <https://timesofindia.indiatimes.com/home/education/news/iit-kharagpur-to-introduce-vastu-shastra/articleshow/58213293.cms> Accessed: 05 September, 2018
- Papadatos, S.P., 1973. Color them motivated—color's psychological effects on students. *NASSP Bulletin*, 57(370), pp.92-94.
- Parasuraman, A., Zeithaml, V.A. and Berry, L.L., 1985. A conceptual model of service quality and its implications for future research. *Journal of marketing*, 49(4), pp.41-50.

- Pardeshi, D., 2017. Vastu Shastra new concept in Architecture. *Journal of Architectural Drawing*, 1(3).
- Parmentier Cajaiba, A., 2010. Research diary visual mapping: A reflective methodological tool for process and strategy-as-practice studies. HAL.
- Pathak, V., Bhatia, M.S., Srinivas, J. and Batra, D., 2011. Emotions and mood. *Delhi Psychiatry Journal*, 14(2), pp.220-227.
- Patra, R., 2009. Vaastu shastra: Towards sustainable development. *Sustainable Development*, 17, 244–256.
- Patton, M.Q., 1990. *Qualitative evaluation and research methods*, 2nd ed. SAGE Publications, inc.
- Patton, M.Q., 2002. *Qualitative Research and Evaluation and Methods*, Sage Publications, Newbury Park.
- Pech, S and Slade, M., 2006. The role of environmental control on environmental satisfaction, communication, and psychological stress: effects of office ergonomics training. *Environment and Behavior*, 36(1), 617-638.
- Pelled, L.H. and Xin, K.R., 1999. Down and out: An investigation of the relationship between mood and employee withdrawal behavior. *Journal of management*, 25(6), pp.875-895.
- Pellitteri, G. and Belvedere, F., 2011. Humanization and architecture in contemporary hospital building. *Considering Research: Reflecting Upon Current Themes in Architectural Research*, p.225.
- Penetar, D.H., McCann, U., Thorne, D., Schelling, A., Galinski, C., Sing, H., Thomas, M. and Belenky, G., 1994. Effects of caffeine on cognitive performance mood and alertness in sleep-deprived humans. *Food components to enhance performance*, pp.407-431.
- Pepler, R.D., 1963. Performance and well-being in heat. *Temperature, its measurement and control in science and industry*, 3(Part 3), pp.319-336.
- Perry Hobson, J.S., 1994. Feng shui: its impacts on the Asian hospitality industry. *International Journal of Contemporary Hospitality Management*, 6(6), pp.21-26.
- Perry, C., 2000. Case research in marketing. *The Marketing Review*, 1(3), pp.303-323.
- Peters, T., 1993. Beating the great blight of dullness. *Forbes*, 152(6), pp.180-181.
- Peterson, C. and Seligman, M.E., 2004. *Character strengths and virtues: A handbook and classification (Vol. 1)*. Oxford University Press.
- Petri, I., Kubicki, S., Rezgui, Y., Guerriero, A. and Li, H., 2017. Optimizing energy efficiency in operating built environment assets through building information modeling: a case study. *Energies*, 10(8), p.1167.
- Pettigrew, A.M., Woodman, R.W. and Cameron, K.S., 2001. Studying organizational change and development: Challenges for future research. *Academy of management journal*, 44(4), pp.697-713.
- Pinder, J., Price, I., Wilkinson, S.J. and Demack, S., 2003. A method for evaluating workplace utility. *Property management*, 21(4), pp.218-229.
- Pitts, J.M., 1995. Personal understandings and mental models of information: A qualitative study of factors associated with the information seeking and use of adolescents.
- Pitzl, G.R. and Pitzl, J., 2004. *Encyclopedia of human geography*. Greenwood Publishing Group.
- Pol, E. and Robson, C., 1993. *Environmental psychology in Europe: From architectural psychology to green psychology (Vol. 3)*. Aldershot: Avebury.

- Ponte, D. and Rizzi, C., 2010. Understanding socialization practice: factors fostering and hindering its evolution. *Society and Business Review*, 5(2), pp.144-154.
- Poole, M. ed., 1999. *Human resource management: critical perspectives on business and management* (Vol. 2). Taylor & Francis.
- Porter, C.O., Hollenbeck, J.R., Ilgen, D.R., Ellis, A.P., West, B.J. and Moon, H., 2003. Backing up behaviors in teams: the role of personality and legitimacy of need. *Journal of Applied Psychology*, 88(3), p.391.
- Poulston, J. and Bennett, R., 2012. Fact, fiction, and feng shui: an exploratory study. *Facilities*, 30(1/2), pp.23-39.
- Prasad, R., 2005. *The Magic of Vaastu Shastra*. Diamond Pocket Books (P) Ltd..
- Preiser, W.F., 1983. The habitability framework: a conceptual approach towards linking human behaviour and physical environment. *Design Studies*, 4(2), pp.84-91.
- Price, J.H. and Murnan, J., 2004. Research limitations and the necessity of reporting them. *American Journal of Health Education* 35 (2004): 66-67
- Purcell, A.T., 1987. The relationship between buildings and behaviour. *Building and Environment*, 22(3), pp.215-232.
- Puthucode Sivaraman, S., 2017. *Concepts from Traditional Indian Architecture to Reduce Energy Consumption in Modern Indian Architecture* (Doctoral dissertation).
- Putnam, L.L. and Mumby, D.K. eds., 2013. *The SAGE handbook of organizational communication: Advances in theory, research, and methods*. Sage Publications.
- Putra, J.C.P., 2017. A study of thermal comfort and occupant satisfaction in office room. *Procedia engineering*, 170, pp.240-247.
- Qin, D., 2016. Positionality. In *The Wiley Blackwell Encyclopedia of Gender and Sexuality Studies* (eds A. Wong, M. Wickramasinghe, r. hoogland and N. A. Naples). doi:10.1002/9781118663219.wbegss619
- Quinn, R. W., 2007. Energizing others in work connections. In Dutton, J.E. and Ragins, B.R., 2017. *Exploring positive relationships at work: Building a theoretical and research foundation*. Psychology Press.
- Quinn, R.W. and Dutton, J.E., 2005. Coordination as energy-in-conversation. *Academy of management review*, 30(1), pp.36-57.
- Raftery, J., McGeorge, D. and Walters, M., 1997. Breaking up methodological monopolies: a multi-paradigm approach to construction management research. *Construction Management & Economics*, 15(3), pp.291-297.
- Ram, M.B., Campling, N., Grocott, P. and Weir, H., 2008. A methodology for a structured survey of the healthcare literature related to medical device users. *Evaluation*, 14(1), pp.49-73.
- Ranjeet, P., Narshima Rao, D.V.S., Akram Ullah Khan., 2016. Vastu in construction in civil engineering point of view. *International Journal of Research in Engineering and Technology*, Volume: 05 Issue: 04
- Raw, G., 1990. Further findings from the office environment survey. In *Proceedings of Indoor Air 1990 conference* (Vol. 1, pp. 231-236).
- Reason, P. and Bradbury, H. eds., 2001. *Handbook of action research: Participative inquiry and practice*. Sage.
- Reason, P. and Torbert, W., 2001. The action turn: Toward a transformational social science. *Concepts and transformation*, 6(1), pp.1-37.

- Reddy, S.M., Chakrabarti, D. and Karmakar, S., 2012. Emotion and interior space design: an ergonomic perspective. *Work*, 41(Supplement 1), pp.1072-1078.
- Reed, M.B. and Aspinwall, L.G., 1998. Self-affirmation reduces biased processing of health-risk information. *Motivation and Emotion*, 22(2), pp.99-132.
- Reis, D.P. and Puente-Palacios, K., 2018. Team effectiveness: the predictive role of team identity. *RAUSP Management Journal*, 54(2), pp.143-153.
- Rimé, B., 2007. Interpersonal emotion regulation. *Handbook of emotion regulation*, 1, pp.466-468.
- Robertson, C.T. and Kesselheim, A.S. eds., 2016. *Blinding as a solution to bias: Strengthening biomedical science, forensic science, and law*. Academic Press.
- Roe, J., 2008. *The restorative power of natural and built environments* (Doctoral dissertation, Heriot-Watt University).
- Roelofs, P., 2002. The impact of office environments on employee performance: The design of the workplace as a strategy for productivity enhancement. *Journal of facilities Management*, 1(3), pp.247-264.
- Rooley, R., 1997. Sick building syndrome-the real facts: what is known, what can be done. *Facilities*, 15(1/2), pp.29-33.
- Rosenhan, D.L., Salovey, P. and Hargis, K., 1981. The joys of helping: Focus of attention mediates the impact of positive affect on altruism. *Journal of Personality and Social Psychology*, 40(5), p.899.
- Roth, J., Shani, A. B., Leary, M. (2007) 'Insider action research: facing the challenge of new capability development within a biopharma company', *Action Research*, 5 (1), pp. 41-60.
- Rothbard, N.P. and Wilk, S.L., 2011. Waking up on the right or wrong side of the bed: Start-of-workday mood, work events, employee affect, and performance. *Academy of Management Journal*, 54(5), pp.959-980.
- Rowley, J. and Slack, F., 2004. Conducting a literature review. *Management research news*, 27(6), pp.31-39.
- Rüger, S., 2016. *How to write a good PhD thesis and survive the viva*. Knowledge media institute. Kents Hill: The Open University.
- Ruiz Arellano, M., 2015. *Hawaiian Healing Center: A weaving of Neuro-architecture and cultural practices*.
- Russell, J.A., 2003. Core affect and the psychological construction of emotion. *Psychological review*, 110(1), p.145.
- Russell, J.A. and Snodgrass, J., 1987. Emotion and the environment, in D. Stokols and I. Altman (eds) *Handbook of Environmental Psychology*, vol. 1, New York.
- Russell, J.A. and Barrett, L.F., 1999. Core affect, prototypical emotional episodes, and other things called emotion: dissecting the elephant. *Journal of personality and social psychology*, 76(5), p.805.
- Russell, J.A. and Barrett, L.F., 2009. Core affect. *The Oxford companion to emotion and the affective sciences*, 104.
- Ryan, R.M. and Frederick, C., 1997. On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of personality*, 65(3), pp.529-565.
- Ryssel, R., Ritter, T. and Georg Gemünden, H., 2004. The impact of information technology deployment on trust, commitment and value creation in business relationships. *Journal of business & industrial marketing*, 19(3), pp.197-207.
- Saaty, T.L., 1972, *Analytic Hierarchy Process*, McGraw-Hill, New York.

- Sahasrabudhe, N.H. and Mahatme, R.D., 2005. Mystic science of vastu. Sterling Publishers Pvt. Ltd.
- Sahasrabudhe, N.H. and Sahasrabudhe, G.N., 2005. Cosmic Science of Vaastu. Sterling Publishers Pvt. Ltd.
- Saldaña, J., 2015. The coding manual for qualitative researchers. Sage.
- Salingaros, N. A., 2007. A theory of architecture. Solingen: ISI Distributed Titles.
- Sallis, J.F., Owen, N. and Fisher, E., 2015. Ecological models of health behavior. *Health behavior: Theory, research, and practice*, 5, pp.43-64.
- Sandelowski, M., 1996. One is the liveliest number: The case orientation of qualitative research. *Research in nursing & health*, 19(6), pp.525-529.
- Sandilya, S., 2015. 93% of home buyers prefer vastu compliant homes: Survey [Online] <https://realty.economictimes.indiatimes.com/news/residential/93-of-home-buyers-prefer-vastu-compliant-homes-survey/50076584> Accessed: 05 September, 2018
- Sarode, A.P. and Shirsath, M., 2012. The factors affecting employee work environment & it's relation with employee productivity. *International Journal of Science and Research (IJSR)*.
- Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H. and Jinks, C., 2018. Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality & Quantity*, pp.1-15.
- Sauro, J. and Lewis, J.R., 2016. Quantifying the user experience: Practical statistics for user research. Morgan Kaufmann.
- Schoenewolf, G., 1990. Emotional contagion: Behavioral induction in individuals and groups. *Modern Psychoanalysis*, 15(1), pp.49-61.
- Schreuder, E., van Heel, L., Goedhart, R., Dusseldorp, E., Schraagen, J.M. and Burdorf, A., 2015. Effects of newly designed hospital buildings on staff perceptions: a pre-post study to validate design decisions. *HERD: Health Environments Research & Design Journal*, 8(4), pp.77-97.
- Schulz, M., Romppel, M. and Grande, G., 2016. Built environment and health: a systematic review of studies in Germany. *Journal of Public Health*, 40(1), pp.8-15.
- Schuman, S., 2006. Creating a culture of collaboration: The International Association of Facilitators handbook (Vol. 4). John Wiley & Sons.
- Schwartz, T. and McCarthy, C., 2007. Manage your energy, not your time. *Harvard business review*, 85(10), p.63.
- Schwarz, N., 2007. Retrospective and concurrent self-reports: The rationale for real-time data capture. *The science of real-time data capture: Self-reports in health research*, 11, p.26.
- Schweitzer, M., Gilpin, L. and Frampton, S., 2004. Healing spaces: elements of environmental design that make an impact on health. *Journal of Alternative & Complementary Medicine*, 10(Supplement 1), pp.S-71.
- Scott, G.G., O'Donnell, P.J. and Sereno, S.C., 2014. Emotion words and categories: Evidence from lexical decision. *Cognitive Processing*, 15(2), pp.209-215.
- Scott, K.W. and Howell, D., 2008. Clarifying analysis and interpretation in grounded theory: Using a conditional relationship guide and reflective coding matrix. *International Journal of Qualitative Methods*, 7(2), pp.1-15.
- Seamon, D., 1984. Emotional experience of the environment. *American Behavioral Scientist*, 27(6), pp.757-770.

- Seery, A. and Loxley, A., 2008. Some philosophical and other related issues of insider research. In *Researching education from the inside* (pp. 23-40). Routledge.
- Selman, P. and Knight, M., 2006. On the nature of virtuous change in cultural landscapes: exploring sustainability through qualitative models. *Landscape Research*, 31(3), pp.295-307.
- Seo, M.G., Barrett, L.F. and Bartunek, J.M., 2004. The role of affective experience in work motivation. *Academy of Management Review*, 29(3), pp.423-439.
- Sereno, S.C., Scott, G.G., Yao, B., Thaden, E.J. and O'Donnell, P.J., 2015. Emotion word processing: does mood make a difference?. *Frontiers in psychology*, 6, p.1191.
- Serghides, D.K., 2010. The Wisdom of Mediterranean Traditional Architecture Versus Contemporary Architecture- The Energy Challenge. *Open Construction and Building Technology Journal*, 4, pp.29-38.
- Sharma, P.G. and Rao, P., 2005. *Teach Yourself Vaastu*. Lotus Press.
- Shemesh, A., Bar, M. and Grobman, Y.J., 2015. SPACE AND HUMAN PERCEPTION-. In *Emerging Experience in Past, Present and Future of Digital Architecture, Proceedings of the 20th International Conference of the Association for Computer-Aided Architectural Design Research in Asia (CAADRIA 2015)* (pp. 541-550).
- Shemesh, A., Talmon, R., Karp, O., Amir, I., Bar, M. and Grobman, Y.J., 2017. Affective response to architecture—investigating human reaction to spaces with different geometry. *Architectural Science Review*, 60(2), pp.116-125.
- Shenton, A.K., 2004. Strategies for ensuring trustworthiness in qualitative research projects. *Education for information*, 22(2), pp.63-75.
- Shirom, A., 2003. Feeling vigorous at work? The construct of vigor and the study of positive affect in organizations. In *Emotional and physiological processes and positive intervention strategies* (pp. 135-164). Emerald Group Publishing Limited.
- Shorrock, L.D. and Henderson, G., 1990. *Energy use in buildings and carbon dioxide emissions*. Watford: Building Research Establishment.
- Shraga, O. and Shirom, A., 2009. The construct validity of vigor and its antecedents: A qualitative study. *Human Relations*, 62(2), pp.271-291.
- Shrivastava, A., Mahajan, K.K., Karla, V. and Negi, K.S., 2009. Effects of electromagnetic forces of Earth on human biological system. *Indian Journal of Preventive and Social Medicine*, 40(3), pp.162-167.
- Shukla, D.N., 1993. *Vaastu Shastra—Hindu science of architecture (Vol. I & II)*. New Delhi: Munshiram Manoharlal.
- Silverman, D., 2006. *Interpreting qualitative data: Methods for analyzing talk, text and interaction*. Sage.
- Silverman, S., 2007. *Vastu: Transcendental home design in harmony with nature*. Gibbs Smith.
- Sime, J.D., 1985. Designing for people or ball-bearings?. *Design Studies*, 6(3), pp.163-168.
- Simeone, D. and Kalay, Y.E., 2012. An Event-Based Model to simulate human behaviour in built environments. *Proceedings of the 30<sup>th</sup> eCAADe Conference*, 525-532.
- Simon, H.A., 2002. Forecasting the future or shaping it?. *Industrial and Corporate Change*, 11(3), pp.601-605.
- Singh, A., Syal, M., Grady, S.C. and Korkmaz, S., 2010. Effects of green buildings on employee health and productivity. *American journal of public health*, 100(9), pp.1665-1668.

- Singh, H., Narayan, S. and Chawla, A., 2011. Seismic Design of Buildings in Accordance with Vastu Shastra. In Proc. of Int. Conf. on Recent Trends in Transportation, Environmental and Civil Engineering.
- Sink, D.S. (1985) Productivity Management: Planning, Measurement and Evaluation, Control and Improvement. New York: Wiley.
- Sinofsky, E.R. and Knirck, F.G., 1981. Choose the right color for your learning style. *Instructional Innovator*, 26(3), pp.17-19.
- Smith, A. and Pitt, M., 2009. Sustainable workplaces: improving staff health and well-being using plants. *Journal of Corporate Real Estate*, 11(1), pp.52-63.
- Smith, M., Hosking, J., Woodward, A., Witten, K., MacMillan, A., Field, A., Baas, P. and Mackie, H., 2017. Systematic literature review of built environment effects on physical activity and active transport—an update and new findings on health equity. *International Journal of Behavioral Nutrition and Physical Activity*, 14(1), p.158.
- Smith, V. and Stewart, B.L., 2006. Feng Shui: a practical guide for architects and designers. Kaplan/AEC Education.
- Snippe, E., Jeronimus, B.F., aan het Rot, M., Bos, E.H., de Jonge, P. and Wichers, M., 2018. The reciprocity of prosocial behavior and positive affect in daily life. *Journal of personality*, 86(2), pp.139-146.
- Sommer, R. and Steiner, K., 1988. Office politics in a state legislature. *Environment and Behavior*, 20(5), pp.550-575.
- Sparks, K., Cooper, C., Fried, Y. and Shirom, A., 1997. The effects of hours of work on health: a meta-analytic review. *Journal of occupational and organizational psychology*, 70(4), pp.391-408.
- Spector, P.E., 1997. Job satisfaction: Application, assessment, causes, and consequences (Vol. 3). Sage publications.
- Spicer, A. and Cederström, C., 2015. The research we've ignored about happiness at work. *Harvard Business Review*, (21).
- Spies, K., Hesse, F. and Loesch, K., 1997. Store atmosphere, mood and purchasing behavior. *International Journal of Research in Marketing*, 14(1), pp.1-17.
- Spreitzer, G., Sutcliffe, K., Dutton, J., Sonenshein, S. and Grant, A.M., 2005. A socially embedded model of thriving at work. *Organization science*, 16(5), pp.537-549.
- Spreitzer, G.M. and Sonenshein, S., 2004. Toward the construct definition of positive deviance. *American behavioral scientist*, 47(6), pp.828-847.
- Srinivasan, S., O'fallon, L.R. and Dearry, A., 2003. Creating healthy communities, healthy homes, healthy people: initiating a research agenda on the built environment and public health. *American journal of public health*, 93(9), pp.1446-1450.
- Stake, R.E., 1995. The art of case study research. Sage
- Stake, R.E., 2010. Qualitative research: Studying how things work. Guilford Press.
- Stand, J., 2000. The "Hawthorne effect"—what did the original Hawthorne studies actually show. *Scand J Work Environ Health*, 26(4), pp.363-367.
- Stanley, J.T. and Isaacowitz, D.M., 2011. Age-related differences in profiles of mood-change trajectories. *Developmental psychology*, 47(2), p.318.
- Steiner, J., 2005. The art of space management: Planning flexible workspaces for people, *Journal of Facilities Management*, Volume 4, Issue 1, pp.6-22

- Steingard, D.S., Fitzgibbons, D.E. and Heaton, D., 2004. Exploring the frontiers of environmental management: A natural law-based perspective. *Journal of Human Values*,10(2), pp.79-97.
- Steinmetz-Wood, M., Pluye, P. and Ross, N.A., 2019. The planning and reporting of mixed methods studies on the built environment and health. *Preventive medicine*, p.105752.
- Stenbacka, C., 2001. Qualitative research requires quality concepts of its own. *Management decision*, 39(7), pp.551-556.
- Sternberg, R.J. and Sternberg, K., 2016. *Cognitive psychology*. Nelson Education.
- Stolwijk, J.A., 1991. Sick-building syndrome. *Environmental Health Perspectives*, 95, pp.99-100.
- Strauss, A. and Corbin, J.M., 1990. *Basics of qualitative research: Grounded theory procedures and techniques*. Sage Publications, Inc.
- Sugano, H., 1987. Psychophysiological research of odors. *Fragrance J.*, no. 86.
- Sui, C.K., 2009. *The Chakras and their Functions*. Institute for Inner Studies Publishing Foundation.
- Sundstrom, E. and Sundstrom, M.G., 1986. *Work places: The psychology of the physical environment in offices and factories*. CUP Archive.
- Sunikka, M. and Boon, C., 2003. Environmental policies and efforts in social housing: The Netherlands. *Building Research & Information*, 31(1), pp.1-12.
- Sunikka, M., 2006. Energy efficiency and low-carbon technologies in urban renewal. *Building Research & Information*, 34(6), pp.521-533.
- Syna Desivilya, H. and Yagil, D., 2005. The role of emotions in conflict management: The case of work teams. *International Journal of Conflict Management*, 16(1), pp.55-69.
- Szalai, A., 1972. *The uses of time*. The Hague, The Netherlands: Mouton in Kannan, S. and Jani, V., 2010. Role of Vaastu in Contemporary Residential Design. *Design Principles & Practice: An International Journal*, 4(5).
- Tanskanen, K., Ahola, T., Aminoff, A., Bragge, J., Kaipia, R. and Kauppi, K., 2017. Towards evidence-based management of external resources: Developing design propositions and future research avenues through research synthesis. *Research Policy*, 46(6), pp.1087-1105.
- Taormina, R.J., 2009. Organizational socialization: the missing link between employee needs and organizational culture. *Journal of Managerial Psychology*, 24(7), pp.650-676.
- Tenkasi, R., Hay, G. W., 2004. 'Actionable Knowledge and Scholar-Practitioners: A Process Model of Theory-Practice Linkages', *Systemic Practice and Action Research*, 17(3), pp. 177- 206.
- Tenório, N., Ferrarezi Vidotti, A., Alaranta, M. and Fulk, H.K., 2017. *The Influence of Positive Emotions on Knowledge Sharing*.
- Thirion-Venter, E.M., 2012. *Embracing Eastern and Western principles: towards an intercultural office design framework (Doctoral dissertation)*.
- Thomas, M. and Hynes, C., 2007. The darker side of groups. *Journal of Nursing Management*, 15(4), pp.375-385.
- Thomas-Mobley, L., Roper, K.O. and Oberle, R., 2005. A proactive assessment of sick building syndrome. *Facilities*,23(1/2), pp.6-15.
- Thornington, L., 1975. Artificial lighting – what colour and spectrum, *Lighting Des. Appli.*, no. 16, 16–21.
- Totaforti, S., 2018. Applying the benefits of biophilic theory to hospital design. *City, Territory and Architecture*, 5(1), p.1.

- Totterdell, P., 1999. Mood score: Mood and performance in professional cricketers. *British Journal of Psychology*, 90, 317–332.
- Totterdell, P., 2000. Catching moods and hitting runs: Mood linkage and subjective performance in professional sport teams. *Journal of Applied Psychology*, 85, 848–859.
- Totterdell, P., Kellett, S., Teuchmann, K. and Briner, R.B., 1998. Evidence of mood linkage in work groups. *Journal of Personality and Social Psychology*, 74(6), p.1504.
- Totterdell, P.A. and Niven, K., 2014. *Workplace moods and emotions: A review of research*. Createspace Independent Publishing.
- Tougwa, F., 2016. THE BUILT ENVIRONMENT DISCIPLINE AND ITS RESEARCH AT DOCTORAL LEVEL.
- Travis, F., Bonshek, A., Butler, V., Rainforth, M., Alexander, C.N., Khare, R. and Lipman, J., 2005. Can a Building's Orientation Affect the Quality of Life of the People Within? Testing Principles of Maharishi Sthapatya Veda. *Journal of Social Behavior and Personality*, 17(1), p.553.
- Tropp, L.R., Stout, A.M., Boatswain, C., Wright, S.C. and Pettigrew, T.F., 2006. Trust and Acceptance in Response to References to Group Membership: Minority and Majority Perspectives on Cross-Group Interactions 1. *Journal of Applied Social Psychology*, 36(3), pp.769-794.
- Tsai, W.C., Chen, C.C. and Liu, H.L., 2007. Test of a model linking employee positive moods and task performance. *Journal of Applied Psychology*, 92(6), p.1570.
- Tuncel, A. and Atan, A., 2013. How to clearly articulate results and construct tables and figures in a scientific paper?. *Turkish journal of urology*, 39(Suppl 1), p.16.
- Tyagi, B., 2013. Listening: An important skill and its various aspects. *The Criterion An International Journal in English*, 12, pp.1-8.
- Tyng, C.M., Amin, H.U., Saad, M.N. and Malik, A.S., 2017. The influences of emotion on learning and memory. *Frontiers in psychology*, 8, p.1454.
- UK Parliament Archives, [Online] <http://www.parliament.uk/about/living-heritage/building/palace/architecture/palacestructure/churchill/> [Accessed: 1 January, 2018]
- Ulrich, R., 2003. The impact of flowers and plants on workplace productivity. Texas A&M University, The Center for Health Systems and Design Study, pp.49-59.
- Urban, V. and Botez, N., 2016. The Importance of Analysing the Employees' Mood. *Economy Transdisciplinarity Cognition*, 19(1), p.40.
- Vaismoradi, M., Jones, J., Turunen, H. and Snelgrove, S., 2016. Theme development in qualitative content analysis and thematic analysis.
- Van Aken, J.E. and Berends, H., 2017. *Problem solving in organizations*. Cambridge University Press.
- Van Bommel, I.W., Van Den Beld, I.G. and Van Ooyen, I.M., 2002. Industrial lighting and productivity. *Philips Lighting*, The Netherlands, p.20.
- Van den Hoonaard, W.C. ed., 2002. *Walking the tightrope: Ethical issues for qualitative researchers*. University of Toronto Press.
- Van der Ryn, S., 2005. *Design for life: the architecture of Sim Van der Ryn*. Gibbs Smith.
- Van Der Voordt, T.J., 2004. Productivity and employee satisfaction in flexible workplaces. *Journal of Corporate Real Estate*, 6(2), pp.133-148.
- Van Der Waals, J., 2001. *CO2-reduction in housing: experiences in building and urban renewal projects in The Netherlands*. Thesis Publishers.

- Van Heugten, K., 2004. Managing insider research: Learning from experience. *Qualitative Social Work*, 3(2), 203-219.
- Van Maanen, J., 1979. The fact of fiction in organizational ethnography. *Administrative science quarterly*, 24(4), pp.539-550.
- Van Maanen, J., 2011. *Tales of the field: On writing ethnography*. University of Chicago Press.
- Vance, R.J., 2006. *Employee engagement and commitment*. SHRM foundation.
- Vartanian, O., Navarrete, G., Chatterjee, A., Fich, L.B., Gonzalez-Mora, J.L., Leder, H., Modrono, C., Nadal, M., Rostrup, N. and Skov, M., 2015. Architectural design and the brain: effects of ceiling height and perceived enclosure on beauty judgments and approach-avoidance decisions. *Journal of environmental psychology*, 41, pp.10-18.
- Vasileiou, K., Barnett, J., Thorpe, S. and Young, T., 2018. Characterising and justifying sample size sufficiency in interview-based studies: systematic analysis of qualitative health research over a 15-year period. *BMC medical research methodology*, 18(1), p.148.
- Vaughan, E., 2013. *The value and impact of building codes*. Washington, DC: Environmental and Energy Study Institute. [Online] Retrieved from [www.eesi.org/papers/view/the-value-and-impact-of-building-codes](http://www.eesi.org/papers/view/the-value-and-impact-of-building-codes). Accessed: 15 October, 2018
- Veitch, J.A. and McColl, S.L., 1994. Full-spectrum fluorescent lighting effects on people: A critical review. *Full-spectrum lighting effects on performance, mood, and health*, pp.53-111.
- Veitch, J.A. and McColl, S.L., 2001. A critical examination of perceptual and cognitive effects attributed to full-spectrum fluorescent lighting. *Ergonomics*, 44(3), pp.255-279.
- Veitch, J.A. and Newsham, G.R., 1998. Lighting quality and energy-efficiency effects on task performance, mood, health, satisfaction, and comfort. *Journal of the Illuminating Engineering Society*, 27(1), pp.107-129.
- Venturi, R., Scott Brown, D., Rattenbury, K., & Hardingham, S. (2007). *Learning from Las Vegas*. Abingdon: Routledge.
- Venugopal, J., 2012. Vastu Purusha Mandala: A human ecological framework for designing living environments. *Advances in Architecture and Civil engineering*, 2(1), pp.870-877.
- Verdinelli, S. and Scagnoli, N.I., 2013. Data display in qualitative research. *International Journal of Qualitative Methods*, 12(1), pp.359-381.
- Vernon, H.M. and Warner, C.G., 1932. The influence of the humidity of the air on capacity for work at high temperatures. *Epidemiology & Infection*, 32(3), pp.431-462.
- Vijayalakshmi K, Tanya M, Nagaraj Y. Analysis of neuro cognitive effects on meditation. *Int J Comput Appl* 2011;36:6–9. In Elbaiuomy, E., Hegazy, I. and Sheta, S., 2017.
- Villanueva, K., Pereira, G., Knuiman, M., Bull, F., Wood, L., Christian, H., Foster, S., Boruff, B.J., Beesley, B., Hickey, S. and Joyce, S., 2013. The impact of the built environment on health across the life course: design of a cross-sectional data linkage study. *BMJ open*, 3(1), p.e002482.
- Vischer, J.C., 2005. *Space meets status: Designing workplace performance*. Oxford, UK: Taylor and Francis/ Routledge.
- Vischer, J.C., 2007. The concept of workplace performance and its value to managers. *California management review*, 49(2), pp.62-79.
- Vischer, J.C., 2007. The effects of the physical environment on job performance: towards a theoretical model of workspace stress. *Stress and health: Journal of the International Society for the Investigation of Stress*, 23(3), pp.175-184.

- Vischer, J.C., 2008. Towards a user-centred theory of the built environment. *Building research & information*, 36(3), pp.231-240.
- Vithayathawornwong, S., Danko, S. and Tolbert, P., 2003. The role of the physical environment in supporting organizational creativity. *Journal of Interior Design*, 29(1-2), pp.1-16.
- Volmer, J., 2012. Catching leaders' mood: Contagion effects in teams. *Administrative Sciences*, 2(3), pp.203-220.
- Wah, L., 1998. Ancient wisdom in modern design. *Management Review*, 87(5), p.13.
- Wang, R., Hempton, B., Dugan, J.P. and Komives, S.R., 2008. Cultural differences: Why do Asians avoid extreme responses?. *Survey Practice*, 1(3).
- Wang, X. and Gianakis, G.A., 1999. Public officials' attitudes toward subjective performance measures. *Public Productivity & Management Review*, pp.537-553.
- Wargocki, P., Wyon, D.P., Baik, Y.K., Clausen, G. and Fanger, P.O., 1999. Perceived air quality, sick building syndrome (SBS) symptoms and productivity in an office with two different pollution loads. *Indoor air*, 9(3), pp.165-179.
- Warkentin, M. and Beranek, P.M., 1999. Training to improve virtual team communication. *Information systems journal*, 9(4), pp.271-289.
- Warr, P., Bindl, U.K., Parker, S.K. and Inceoglu, I., 2014. Four-quadrant investigation of job-related affects and behaviours. *European Journal of Work and Organizational Psychology*, 23(3), pp.342-363.
- Warren, C. and Warrenburg, S., 1993. Mood benefits of fragrance, *Perfumer and Flavourist*, 18, Mar./Apr., 9–16, in Clements-Croome, D., 2000. *Creating The Productive Workplace*, D. Clements Croome, ed, London: E & FN Spon.
- Watson, D., & Tellegen, A., 1985. Toward a consensual structure of mood. *Psychological Bulletin*, 98, 219–235.
- Weinreb, A.R. and Rofè, Y., 2013. Mapping feeling: An approach to the study of emotional response to the built environment and landscape. *Journal of Architectural and Planning Research*, pp.127-145.
- Weinschenk, S., 2011. *100 things every designer needs to know about people*. Pearson Education.
- Weinstein, N., Przybylski, A.K. and Ryan, R.M., 2009. Can nature make us more caring? Effects of immersion in nature on intrinsic aspirations and generosity. *Personality and Social Psychology Bulletin*, 35(10), pp.1315-1329.
- Wellman, B., Salaff, J., Dimitrova, D., Garton, L., Gulia, M. and Haythornthwaite, C., 1996. Computer networks as social networks: Collaborative work, telework, and virtual community. *Annual review of sociology*, 22(1), pp.213-238.
- Wells MM., 2000. Office clutter or meaningful personal displays: The role of office personalization in employee and organizational well-being. *Journal of Environmental Psychology*. Sep 1;20(3):239-55.
- Wells, N.M., Evans, G.W. and Cheek, K.A., 2016. Environmental psychology. *Environmental health: From global to local*, 203.
- Weston, H.C. and ADAMS, S., 1935. The performance of weavers under varying conditions of noise. *The Performance of Weavers under Varying Conditions of Noise.*, (70).
- Wijewardane, S. and Jayasinghe, M.T.R., 2008. Thermal comfort temperature range for factory workers in warm humid tropical climates. *Renewable Energy*, 33(9), pp.2057-2063.
- Wilkins, A.J., 1993. Health and efficiency in lighting practice. *Energy*, 18(2), pp.123-129.
- Wilkins, A.J., Nimmo-Smith, I., Slater, A.I. and Bedocs, L., 1989. Fluorescent lighting, headaches and eyestrain. *Lighting Research & Technology*, 21(1), pp.11-18.

- Williams, B., 2002, *An Introduction to Benchmarking Facilities*, (Building Economics Bureau Limited ISBN 0904237257)
- Williams, L.M., 2013. *Getting to know the built environment as a complex system*. Wellesley Institute.
- Williams, S. and Shiaw, W.T., 1999. Mood and organizational citizenship behavior: The effects of positive affect on employee organizational citizenship behavior intentions. *The Journal of Psychology*, 133(6), pp.656-668.
- Willis, S., Clarke, S. and O'Connor, E., 2017. Contextualizing leadership: Transformational leadership and Management-By-Exception-Active in safety-critical contexts. *Journal of Occupational and Organizational Psychology*, 90(3), pp.281-305.
- Wilson, S. and Hedge, A., 1987. *The office environment survey: a study of building sickness*. Building Use Studies Limited.
- Woods, B., Byrne, A. and Bodger, O., 2018. The effect of multitasking on the communication skill and clinical skills of medical students. *BMC medical education*, 18(1), p.76.
- Woods, S.A., Poole, R. and Zibarras, L.D., 2012. Employee absence and organizational commitment. *Journal of Personnel Psychology*.
- Wright, T., 2009. Happy Employees Are Critical For an Organization's Success, Study shows. *Science Daily*. Retrieved September, 22, p.2010.
- Wright, T.A. and Cropanzano, R., 2000. Psychological well-being and job satisfaction as predictors of job performance. *Journal of occupational health psychology*, 5(1), p.84.
- Wright, T.A. and Staw, B.M., 1999. Affect and favorable work outcomes: two longitudinal tests of the happy-productive worker thesis. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 20(1), pp.1-23.
- Wyon, D.P., 1993. Healthy buildings and their impact on productivity. *Indoor air '93', thermal environment, building technology, cleaning*, 6, pp.3-14.
- Wyon, D.P., 1996, October. Indoor environmental effects on productivity. In *Proceedings of IAQ (Vol. 96, pp. 5-15)*.
- Xie, Z.Y., Hu, X.J. and Zhao, Z., 2012. Construction of ecological convalescent health plants field based on five elements Theory. In *Applied Mechanics and Materials (Vol. 174, pp. 2672-2677)*. Trans Tech Publications.
- Xu, P., 1998. " FENG-SHUI" MODELS STRUCTURED TRADITIONAL BEIJING COURTYARD HOUSES. *Journal of Architectural and Planning Research*, pp.271-282.
- Xue, H., Zhang, S., Su, Y. and Wu, Z., 2018. Capital cost optimization for prefabrication: A factor analysis evaluation model. *Sustainability*, 10(1), p.159.
- Y.S. Lincoln and E.G. Guba, *Naturalistic inquiry*, Beverly Hills: Sage, 1985.
- Yardley, J.K. and Rice, R.W., 1991. The relationship between mood and subjective well-being. *Social Indicators Research*, 24(1), pp.101-111.
- Yin, R.K., 2015. *Qualitative research from start to finish*. Guilford Publications.
- Yu, K., 1994. Landscape into places: Feng Shui model of place making and some cross-cultural comparisons. *Proceedings of the council of educators in landscape architecture (CELA 94)*, pp.320-340 as mentioned in Han, K.T., 2009. *FENG SHUI AND HARMONY*.
- Yuen, K.S. and Lee, T.M., 2003. Could mood state affect risk-taking decisions?. *Journal of affective disorders*, 75(1), pp.11-18.

Yukl, G.A. and Becker, W.S., 2006. Effective empowerment in organizations. *Organization Management Journal*, 3(3), pp.210-231.

Zajonc, R.B., 1980. Feeling and thinking: preferences need no inferences. *Am. Psychol.*, 39, 117–123.

Zube, E.H. and Moore, G.T. eds., 2013. *Advances in environment, behavior and design (Vol. 2)*. Springer Science & Business Media.

Zuber-Skerritt O., Fletcher M., 2015. Professional Learning through an Action Research Thesis. In: *Professional Learning in Higher Education and Communities*. Palgrave Macmillan, London