

POST OCCUPANCY EVALUATION: DEVELOPMENT OF AN INSTRUMENT AND
A PROCESS TO ASSESS OCCUPANT SATISFACTION IN RENOVATED
UNIVERSITY OFFICE SETTINGS: A CASE STUDY APPROACH

By

Sagata Bhawani

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTERS OF SCIENCE

Construction Management

2011

ABSTRACT

POST OCCUPANCY EVALUATION: DEVELOPMENT OF AN INSTRUMENT AND A PROCESS TO ASSESS OCCUPANT SATISFACTION IN RENOVATED UNIVERSITY OFFICE SETTINGS: A CASE STUDY APPROACH

By

Sagata Bhawani

The increasing importance of continuous improvement in the building industry has rendered post occupancy evaluation (POE) as an essential tool to examine the success of building design and performance after occupancy. POE has not been in the forefront for several decades but there is renewed interest due to emergence of facilities management as a major discipline in the procurement and management of buildings, especially, amongst large owners. This revived interest has resulted in research endeavors to further enhance POE methods for users in various settings and identification of function specific evaluation factors.

This study focused on determination of functional and indoor environment performance factors specific to renovated office facilities in university settings. These factors were used to develop a trial POE survey that would assess occupant satisfaction level in a facility. The trial POE survey was tested in two university buildings at Michigan State University. The results were used to modify the POE survey. This research also provided a methodology to develop a survey and a process to conduct POE in university settings for faculty and staff occupied spaces.

This thesis is dedicated to

God, my heavenly father

Ma, Pa, and Boni

Prayer:

Where the mind is without fear and the head is held high

Where knowledge is free

Where the world has not been broken up into fragments

By narrow domestic walls

Where words come out from the depth of truth

Where tireless striving stretches its arms towards perfection

Where the clear stream of reason has not lost its way

Into the dreary desert sand of dead habit

Where the mind is led forward by thee

Into ever-widening thought and action

Into that heaven of freedom, my Father, let my country awake.

-A Poem by

Rabindranath Tagore

AKNOWLEDGEMENTS

In life, I have learned that people are our most precious treasure, most insightful resource, and the most amazing source of inspiration. Our world is what we make it, yes, but partially; and partially it becomes who we have and who have us. This thesis document is my memento of this deep realization and of my days at Michigan State University (MSU) as a graduate student and professional. The little acts of kindness and words of encouragement from known persons and, even strangers has been my unique teacher along this way.

First of all, I am grateful to God for giving me a bountiful life and a supportive family. I thank my dad, whose faith in me has always given me strength and conviction in myself; my mom, whose love, perseverance, and patience has made me the person I am; my little sister, who is my best friend and my rescue angel, and my cousins who have been my moral support.

The most important person and the one who contributed immensely to this thesis is my principal advisor, Professor Tim Mrozowski. However, his contribution to my life goes beyond this thesis. I am forever grateful to him for guiding me, for having faith in me, and for helping me overcome all kinds of challenges throughout my master's education. His encouragement and affection continues to contribute to my confidence, enthusiasm, determination, and realization of my true potential, in professional and personal life.

A constant pillar of love, support, and encouragement is my co-advisor, Dr. Tariq Abdelhamid. When it got a little weary along the way, his cartoon strips and YouTube

videos would fill me with more vigor than I can express in mere words. He is like a guardian angel for me. I am also extremely grateful to my third committee member, Dr. Patricia Huddleston, whose patience and support has been a priceless contribution to this research and my confidence.

I am thankful to my professor, Dr. Matt Syal for sharing his knowledge and war stories thereby helping me prepare for the eventful days to come as I shall step into the industry once again. I am grateful to Dr. Elgafy who is my professor and a good friend. His “Lake Lansing Summer Parties” have always been a great source of fun and relaxation. His personal recommendations have always helped me to confidently introduce myself to various industry professionals.

I wish to offer a very special and warm thanks to Dr. Joanne Westphal and Dr. John Schweitzer for being my mentors and parent-like figures, thereby teaching me bits and pieces of research while letting me have a good time with them. They hold a very special place in my heart.

I wish to thank Ms. Kathy Lindahl for providing timely input and direction to take this study from one level to another. Her role in this study was most unique and irreplaceable. My heartfelt thanks to Mr. Jack Mumma for being a mentor, Ms. Cherie Shorman, and all my colleagues at Campus Planning and Administration for being considerate and supportive all throughout my last two semesters at MSU. I wish to acknowledge all those individuals who provided valuable insight in the initial phase of this study: Ms. Barbara Kranz, Mr. Jeff Kacos, Ms. Christine Carter, Dr. Scott Whitter, Ms. Judy Pardee, Dr. Bill Latta, Mr. Brad Bull, Shari Margraves, and Ms. Christine Lockwood. Thank you all.

I thank you Cathy for all your candies and warm wishes through the hungry cold evenings after classes. I am thankful to Mary Ann for accepting my time sheets way past due dates and, to Pat and Judy for helping with all the career fair organization and travel vouchers. I thank you Valerie for finding me my first roommate in U.S. and, for the timely guidance throughout the duration of my degree. I thank you Pooja for being my inspiration since I first decided to come to MSU.

Next, I wish to thank the MSU writing center representative: Hiep, who spent hours helping me refine the language and structure of this document, before submission to my advisor. Additional thanks to the Graduate school for its time and consideration to review the format and graphic of the thesis document. Further, this acknowledgement would be incomplete without the mention of our respected OISS Director: Mr. Peter Briggs, the School of Planning, Design and Construction, and the Graduate School, who supported me by approving emergency funds towards enrollment in my second last semester.

Here on, I would like to thank all those people who have contributed in one way or other to my overall growth, who have been my constant support behind the scenes:

- Kipa Architects, India: Kirit, Archana, Anupama, Atul, Beck, Sneha, Apekshit
- National Association of Women in Construction, Lansing Chapter, (especially Karen and Tracy).
- Clark Construction Company, Lansing, MI (especially Loic Couraud, Duane Wixson, Paul Clark, and Karen Kelly).
- MSU Physical Plant (especially Leisa Williams Swedberg, Brad Bull, and Jessica).

- My friends, who have been my family away from home as I sailed through the last four years: Sanil, Roveena, Nandini, Aman, Sonko, Rajat, Pranav, Lipika, Sam, Don, Surabhi, Ankur, and Ali. Thank you all for your affection, encouragement, and support.

Thank you all!

TABLE OF CONTENTS

LIST OF TABLES.....	xiii
---------------------	------

LIST OF FIGURES.....	xiv
----------------------	-----

CHAPTER 1

INTRODUCTION

1.1. Post Occupancy Evaluation.....	1
1.2. Need Statement.....	3
1.3. Research Project Establishment.....	6
1.4. Research Goal and Objectives.....	7
1.5. Research Methodology.....	8
1.6. Research Scope and Limitations.....	9
1.7. Research Deliverables.....	11
1.8. Chapter Summary.....	12

CHAPTER 2

LITERATURE REVIEW

2.1. Chapter overview.....	13
2.2. Post Occupancy Evaluation (POE).....	15
2.2.1 Levels of POE.....	17
Indicative Level.....	18
Investigative Level.....	19
Diagnostic Level.....	19
2.2.2 Benefits of POE.....	21
2.2.3 Barriers to Conducting POE.....	23
2.2.4 Phases of POE.....	25
2.2.5 Dimensions of POE.....	28
2.3. Post Occupancy Evaluation (POE) Factors.....	29
2.3.1 Functional Performance Factors.....	32
2.3.2 Indoor Environment Factors.....	34
2.4. Post Occupancy Evaluation: Application.....	36
2.5. Post Occupancy Evaluation Instruments.....	39
2.6. Significant POE Studies using Survey Questionnaires.....	45
Center for Built Environment.....	46
Guide to Post Occupancy Evaluation, HEFCE and AUDE, 2006.....	47
CABE 2005 Study.....	48
CSBR 2004 Study.....	49
Levermore and Leventis, 1997.....	50
Menzies and Wherett, 2004.....	50
2.7. Chapter Summary.....	51

CHAPTER 3

METHODOLOGY

3.1.	Chapter Overview.....	53
3.2.	Overall Methodology.....	54
3.3.	Research Project Establishment.....	58
3.4.	Literature Review: Identification of Evaluation Factors and POE Methods.....	58
3.5.	Interviews.....	59
3.6.	Development of Initial or Trial POE Survey Questionnaire.....	61
3.7.	POE Survey Review and University Approval.....	62
3.8.	Distribution and Collection of POE Surveys.....	62
3.9.	Description of Trial POE Survey.....	63
3.9.1	Functional Performance.....	64
3.9.2	Indoor Environment Performance.....	66
3.9.3	Participant Information.....	67
3.9.4	Survey Feedback.....	67
3.10.	Data Recording and Arrangement.....	68
3.11.	Data Analysis.....	68
3.12.	Chapter Summary.....	69

CHAPTER 4

DATA COLLECTION AND ANALYSIS

4.1.	Chapter Overview.....	70
4.2.	Interviews.....	70
4.2.1	Analysis of Interview Responses.....	71
4.3.	Post Occupancy Evaluation: Application of Trial Survey.....	78
4.3.1	Case Study No.1 School of Planning Design and Construction.....	79
4.3.1.1	Overall Survey Response.....	79
4.3.1.2	Survey Participant Information.....	80
4.3.1.3	Building Specific Information and Analysis.....	82
A.	Functional Performance.....	82
B.	Indoor Environmental Performance.....	84
C.	Discussion of Open-ended Responses.....	86
4.3.1.4	Survey Feedback Analysis: (Section 4 of the POE Questionnaire)	89
4.3.1.5	Occupant Observations, Suggestions, and Recommendations....	92
4.3.2	Case Study No.2 Spartan Way.....	93
4.3.2.1	Overall Survey Response.....	94
4.3.2.2	Survey Participant Information.....	94
4.3.2.3	Building Specific Information and Analysis.....	97
A.	Functional Performance.....	97
B.	Indoor Environmental Performance.....	99
C.	Discussion of Open-ended Responses.....	101
4.3.2.4	Survey Feedback Analysis: (Section 4 of the POE Questionnaire).....	107
4.3.2.5	Occupant Observations, Suggestions, and Recommendations....	110

4.4.	Comparative Analysis of Survey Feedback from S.P.D.C. and Spartan Way....	112
4.5.	Conclusions.....	118
4.6.	Chapter Summary.....	118

CHAPTER 5

POST OCCUPANCY EVALUATION SURVEY

5.1.	Chapter Overview.....	119
5.2.	Researcher's Observations.....	119
5.3.	Respondent's Recommendations.....	125
5.4.	Modified POE Survey Questions.....	130
5.5.	Conclusion.....	131
5.6.	Chapter Summary.....	131

CHAPTER 6

POST OCCUPANCY EVALUATION PROCESS

6.1.	Chapter Overview.....	132
6.2.	Post Occupancy Evaluation Process.....	132
	6.2.1 Project Establishment Phase.....	136
	6.2.2 Data Collection and Analysis Phase.....	137
	6.2.3 Reporting Phase.....	138
	6.2.4 University Standards and Corrective Action Phase.....	139
6.3.	POE Process Limitations.....	139
6.4.	Conclusion.....	140
6.5.	Chapter Summary.....	140

CHAPTER 7

SUMMARY AND CONCLUSIONS

7.1	Chapter Overview.....	141
7.2	Research Overview.....	141
7.3	Accomplishment of Research Goal and Objectives.....	143
7.4	Lessons Learned.....	144
	7.4.1 Lessons Learned from Literature Review.....	144
	7.4.2 Lessons Learned from Interviews.....	146
	7.4.3 Lessons Learned from Surveys.....	147
	7.4.4 Lessons Learned from Data Analysis.....	148
	7.4.5 Lessons Learned from Application of POE Process.....	149
	7.4.6 Lessons Learned about POE Project Team.....	152
	7.4.7 Lessons Learned about POE factors.....	153
	7.4.8 Lessons Learned about POE Questionnaire.....	153
7.5	Conclusion and Inferences.....	154
7.6	Research Benefits and Contribution.....	155
7.7	Future Research Directions.....	156
7.8	Chapter Summary.....	157

APPENDICES

Appendix A: Interviews

Appendix A1: Interview Participant Consent Form.....	160
Appendix A2: Project Abstract.....	162
Appendix A3: Interview Questionnaire.....	164
Appendix A4: Interview Response Record Sheet for Qualitative Analysis.....	170

Appendix B: Post Occupancy Evaluation Survey

Appendix B1: Consent Form.....	200
Appendix B2: Trial POE Questionnaire.....	202
Appendix B3: Survey Response Code Sheet.....	211
Appendix B4: Survey Response Record Sheet for SPDC.....	214
Appendix B5: Survey Response Record Sheet for Spartan Way.....	225
Appendix B6: Survey Feedback Section Comparative Analysis Sheet.....	250
Appendix B7: Modified POE Questionnaire.....	262

Appendix C: Sample Post Occupancy Evaluation Questionnaires

Appendix C1: CBE Sample POE Questionnaire.....	276
Appendix C2: AUDE Sample POE Questionnaire.....	285
Appendix C3: CSBR Sample POE Questionnaire.....	292

BIBLIOGRAPHY.....	295
-------------------	-----

LIST OF TABLES

Table 1.1	Features that Influence Staff Retention (CABE 2005).....	4
Table 2.1	Levels of Post Occupancy Evaluation (Preiser 1995).....	18
Table 2.2	Levels of Post Occupancy Evaluation (Brooks and Viccars 2006).....	20
Table 2.3	Benefits of Post Occupancy Evaluation.....	22
Table 2.4	Comparison of POE Methods (Brooks and Viccars 2006).....	40
Table 2.5	Comparison of POE Questionnaires (Brooks and Viccars 2006).....	41
Table 2.6	Comparison of POE Method (AUDE and HEDQF 2006).....	42
Table 2.7	Types of Reviews (AUDE and HEDQF 2006).....	44
Table 4.1	Count of Open-ended Responses at the S.P.D.C.....	86
Table 4.2	Count of Open-ended Responses at Spartan Way.....	101
Table 4.3	Survey Feedback: Comparative Analysis of Response Summary.....	113
Table 4.4	Survey Feedback Section: Suggestions for Functional and Indoor Environment Aspects and Questions to be included in Evaluation (Verbatim).....	116
Table 4.5	Survey Feedback: Comments on Unclear, Confusing, and Unnecessary Questions (Verbatim).....	117
Table 5.1a	S.P.D.C. Responses to Questions 1 – 8 (Verbatim).....	120
Table 5.1b	Spartan Way Responses to Questions 1 – 8 (Verbatim).....	121
Table 5.2a	S.P.D.C. Responses to Questions 18 – 23.....	124
Table 5.2b	Spartan Way Responses to Questions 18 – 23.....	124

Table 5.3	Reasons for Accepting or Rejecting Recommended Aspects and Actions Taken Towards POE Survey.....	126
Table 5.4	Reasons for Accepting or Rejecting Recommended Questions and Actions Taken Towards POE Survey.....	127
Table 5.5	Reasons for Accepting or Rejecting Comments for Unnecessary/ Confusing Questions and Actions Taken Towards POE Survey.....	129
Table A4.1	Interview Response Record Sheet for Qualitative Analysis.....	171
Table B3.1	POE Survey Response Coding Plan.....	212
Table B4.1	POE Survey Record Sheet for S.P.D.C.....	215
Table B5.1	POE Survey Record Sheet for Spartan Way.....	226
Table B6.1	Survey Feedback Section Comparative Analysis Sheet for SPDC and Spartan Way.....	251

LIST OF FIGURES

Figure 2.1	Literature Review Structure Overview.....	13
Figure 2.2	Detail Structure of Literature Review.....	14
Figure 2.3	Structure of Section 2.2: Post Occupancy Evaluation.....	17
Figure 2.4	Phases of Post Occupancy Evaluation (Source: Keys and Wener, 1980).....	26
Figure 2.5	Relationship between Environment Conditions, Occupancy Satisfaction, Productivity and Motivation (Source: Keys and Wener, 1980).....	30
Figure 2.6	Phases of POE (Source: Preiser, 2002).....	37
Figure 2.7	Post Implementation Review Process (Source: New South Wales Treasury, 2004).....	38
Figure 2.8	POE Process Overview (Source: AUDE and HEDQF, 2006).....	39
Figure 2.9	Snapshot of CBE Web-based Survey, 2009.....	47
Figure 2.10	Snapshot of Occupant Survey in Guide to POE, HEFCE and AUDE, 2006.....	48
Figure 2.11	Snapshot of Occupant Survey Form, SWMCB POE: Carver County Public Works Department (Source: CSBR 2004).....	50
Figure 3.1	Overview of the Research Methodology.....	53
Figure 3.2	Phase 1 Overview.....	54
Figure 3.3	Phase 2 Overview.....	55
Figure 3.4	Phase 3 Overview.....	56
Figure 3.5	Phase 4 Overview.....	57
Figure 3.6	Structure of ‘Satisfaction’ and ‘Open-ended’ Questions	65

Figure 3.7	Structure of “Yes-No” Questions	65
Figure 4.1	Snapshot of Interview Record Spreadsheet.....	71
Figure 4.2	Overview of Survey Utilization process.....	78
Figure 4.3	Participant and Workspace Information at S.P.D.C.....	81
Figure 4.4	Occupant Satisfaction with Functional Performance at the S.P.D.C.....	82
Figure 4.5	Occupant Satisfaction Level with Functional Performance Aspects at the S.P.D.C.....	83
Figure 4.6	Occupant Satisfaction with Indoor Environmental Performance Aspects at S.P.D.C.....	84
Figure 4.7	Occupant Satisfaction Level with Indoor Environment Performance at the S.P.D.C.....	85
Figure 4.8	Q1: How satisfied are you with the format of the survey?	90
Figure 4.9	Q2: How satisfied are you with the appropriateness of the questions?.....	90
Figure 4.10	Q3: Please comment on the balance of open ended to closed response questions.....	90
Figure 4.11	Q4: In the future, which method of interaction would you prefer for this kind of study?	91
Figure 4.12	Q5: In your opinion, to what extent did the survey cover aspects that you would like to comment upon about your office?	91
Figure 4.13	Q6: In your opinion, to what extent did the survey cover aspects that you would like to comment upon about your office?	91
Figure 4.14	Q7: Do you consider that right questions are being asked of building occupants?.....	92
Figure 4.15	Q8: Does the survey allow you to effectively indicate your satisfaction with the design of your workspace?	92
Figure 4.16	Participant and Workspace Information at Spartan Way.....	96
Figure 4.17	Occupant Satisfaction with Functional Performance at the Spartan Way.....	97

Figure 4.18	Occupant Satisfaction Level with Functional Performance Aspects at Spartan Way.....	98
Figure 4.19	Occupant Satisfaction Level with Indoor Environmental Performance aspects at Spartan Way.....	99
Figure 4.20	Occupant Satisfaction Level with Indoor Environment Performance at Spartan Way.....	100
Figure 4.21	Q1: How satisfied are you with the format of the survey?	108
Figure 4.22	Q2: How satisfied are you with the appropriateness of questions?	108
Figure 4.23	Q3: Please comment on the balance of open ended to closed response questions.....	108
Figure 4.24	Q4: In the future, which method of interaction would you prefer for this kind of study?	109
Figure 4.25	Q5: How satisfied would you feel if these questions were asked in a focus group of persons occupying adjacent workspaces as compared to this survey?	109
Figure 4.26	Q6- In your opinion, to what extent did the survey cover aspects that you would like to comment upon about your office?.....	109
Figure 4.27	Q7- Do you consider that right questions are being asked of building occupants?.....	110
Figure 4.28	Occupant Perception: Does the survey allow you to effectively indicate your satisfaction with the design of your workspace?.....	110
Figure 4.29	Snapshot of Worksheet with Combined Responses from the S.P.D.C. and Spartan Way.....	112
Figure 6.1	Post Occupancy Evaluation Process.....	133
Figure 7.1	Suggested Literatures Database “Post Occupancy Evaluation”.....	145

CHAPTER 1

INTRODUCTION

This chapter presents a background of post occupancy evaluation, which is the heart of this project. It also introduces the need for this research followed by a discussion of the goal and objectives, methodology, scope and limitations, and deliverables of this study.

1.1. Post Occupancy Evaluation:

Post occupancy evaluation (POE) may be defined as the process of systematically evaluating buildings after they have been built and occupied for some time. POE differs from other building evaluations in that it focuses on the comfort and requirements of building users, with regard to aspects such as their health, safety, security, functionality and efficiency, psychological comfort, aesthetic quality, and satisfaction (Preiser 2002).

Traditionally, POE concentrates on the effect of the “built environment” on users rather than the organizational culture or work processes. The broader purpose of POE is to understand the environmental-behavioral aspects of human perceptions, to measure the appropriateness of building design, to provide better spatial solutions for users, and to determine the effectiveness of decisions made towards the utilization of resources during building design and construction (Preiser 2001 as cited in Lee, 2007).

POE is an outcome of the culmination of interests among social scientists, building designers, and planners during the 1960s and the 1970s (Friedmann et al. 1978; Preiser et al. 1988; Preiser et al. 1997; Shipley 1982 as cited in Zimring 2001). It

originated in the United Kingdom and spread to the United States of America, Australia, New Zealand, and several developed nations. By the 1980s, it had significantly advanced in theory, method, strategy, and applications; it became the center of attention and the meeting point for discrete research areas such as the built environment, facility management, and building delivery process (Preiser 1988; Zimring 2001; Kooymans and Haylock 2006). Since its inception, several studies have been conducted to identify the diversity and variety in application of POE.

The Kooymans and Haylock 2006 study assessed four newly renovated financial institutions using building user surveys with a focus on staff attitude and productivity. Their study found that staff productivity was related to the “built environment”. They also found that for the best results, POE must be designed and analyzed by a team of professionals from multiple disciplines familiar with building design, construction, operation, and maintenance. In this thesis study, the overall POE process and the instrument were designed by the researcher using the perceptions of building providers and building users.

POE originally started in government and private organizations; however, in the last few decades it has also been adopted for health care, commercial, institutional, and other large facilities. It is recommended that POE should be an integral part of the building delivery process and lead by facility owners and managers (Preiser 2002 as cited in Carthey 2006; Duffy 1998; Horgen et al. 1999 as cited in Zimring 2001; Preiser 2008; Marans 1984; RIBA 1991; Shepley 1997; Schneekloth and Shipley 1995; Zimmerman and Martin 2001). Existing research shows that POE is particularly beneficial for large organizations that have recurring construction programs or significant volumes of

facilities which require periodic remodeling and renovations. Universities are a good example of such facilities; where POE instruments can serve as tools for continuous improvement by facilitating feedback on the delivery process and facility management (Guide to POE by AUDE and HEDQF 2006; Preiser 1995).

Some of the institutional organizations that apply and encourage POEs are: the Association of University Directors of Estates (AUDE), the Higher Education Design Quality Forum (HEDQF) in the U.K., the Estates at Scotland's Colleges and Universities, and the Center for Built Environment at Berkley, California, U.S.A. In spite of repetitive attempts by POE proponents to make POE routine across all facility types, it is still not routine to the building delivery process among universities, due to lack of standardized processes and limitations in resources (Bordass and Leaman 2005).

1.2. Need Statement

The purpose of this research is to provide a tool to continuously improve building design performance for occupants and facility management for owners. This research study contributes to the ability of university administrators' to have a positive influence on the attitude and productivity of university faculty and staff by providing a process to track their satisfaction levels with regard to their personal work spaces. The need for this study was established based on the findings from several existing POE studies. These studies are presented briefly in the next two paragraphs and elaborately in chapter two, "Literature Review".

The 2005 study by CABA (Commission for Architecture and Built Environment) in the U.K. addressed the impact of building design on the performance of occupants in

higher education buildings. The CABA study found that the staff in higher education buildings considered building design features to have a positive impact on their decision to work at their chosen university. As shown in Table 1.1, the staff indicated that situational features such as the external views and surroundings and, specific building features such as cleanliness and spacious, bright working areas had a strong influence on the way they feel and behave at work.

STAFF PERCEPTION: OVERALL FEATURES THAT INFLUENCE STAFF RETENTION		
CATEGORY OF FEATURE	FEATURE	STAFF % POSITIVE
STRUCTURAL AND FUNCTIONAL	Function/facilities	76%
	Office and work space	70%
	Size/proportion/openness	60%
	Lighting	58%
	Stimulating character	55%
	Accessibility/entrance	53%
	Materials	52%
	Teaching rooms	52%
	Flexible spaces	49%
	Research facilities	37%
	Acoustics	31%
	All features	54%
COSMETIC AND ENVIRONMENTAL	Decoration/furnishings	64%
	WOW factor	62%
	Health/safety/security	58%
	Staff rooms	49%
	Air quality/ventilation	32%
	Heating/cooling	25%
	All features	48%
SITUATIONAL	External views, surroundings	61%

Table 1.1: Features that Influence Staff Retention (CABA 2005)

The CABE 2005 study also contended that higher education facilities should be designed to accommodate the various spatial functions for faculty, staff, and students; however, the environmental needs of the staff and faculty may be different than those of the students due to the separate functional roles and requirements. For office areas used by faculty and staff, priorities may be thermal comfort, furniture layout, storage space, and ease of interaction; whereas for classrooms and libraries, used by students, priorities may be lighting and acoustic conditions. Therefore, POE must be conducted separately for faculty, staff, and students to determine their satisfaction specific to their requirements and preferences. Based on the finding above, this thesis study was designed to focus on satisfaction of faculty and staff with their personal workspaces. Student populations have been excluded in the scope of this study and their inclusion is suggested for follow-up research.

The Kooymans and Haylock 2006 study found that the built environment, work processes, and work culture, influence productivity and satisfaction of staff in organizations. The Watson 1996 study found that evolving laws, market trends, and information technology have changed the activity description and corresponding design requirements for many organizations. This information should lead to changes in perspective for large facility administrators, with regard to the function, and of work environments from short-term to long-term consideration as well as recognizing the links between organizational performance and the physical work environment.

This thesis study will help university organizations identify the elements of the physical work environment that will further enhance the work experience of faculty and staff, and if implemented, will generate higher satisfaction and productivity levels. This

study develops a POE survey for university office renovation which facilitates a periodic dialogue between the building occupants and managers about their environmental and functional needs and preferences. Additionally, the POE survey will act as a tool for gathering feedback that will support future decisions about expenditure toward design and construction for university facilities. According to Kincaid (1994) and Preiser (1995), the data collected across universities could also facilitate a benchmarking process among diverse universities for best practices.

1.3. Research Project Establishment

This research study is a portion of a larger project envisioned and funded by the Michigan State University Office of Vice President of Finance and Operations. The purpose of the larger project is to develop a comprehensive post occupancy evaluation system to assess the performance of all types of buildings on campus with regard to their design, construction, operation, and maintenance. The research team defined the smaller project scope and focus based on the evidence found during preliminary literature review. It was decided that the goal of this research would be to contribute to the improvement of functional and indoor environment performance of university faculty and staff work spaces. The fact that this study focuses only on the functional and indoor environment performance of only university office spaces may be a limitation for the smaller study but is the starting point for the larger project envisioned. It is predicted that in the future the larger project will encompass similar smaller studies to evaluate other area types within universities such as student spaces, research laboratories, parking spaces, and sport spaces. Each of the smaller studies can follow a methodology similar to this study and

reveal the function, user, or area type-specific preferences that differ from one to the other.

1.4. Research Goal and Objectives

The goal of this research is to improve the functional design, the indoor environment, and the operation of work spaces in university buildings. Objectives designed to help achieve the overall research goal are presented below:

1. To develop a survey using identified evaluation factors that can help determine the functional and indoor environment performance of university office settings from the building users' perceptions
2. To develop a methodology for universities to conduct post occupancy evaluation studies for other settings

These research objectives were accomplished with the help of the following research steps:

- A. Identification of functional and indoor environmental factors that affect faculty and staff satisfaction in university work spaces
- B. Development of a preliminary POE survey with the help of identified evaluation factors or performance indicators
- C. Proposition of a methodology to assess functional and indoor environment performance of university work spaces, including the developed POE survey
- D. Development and application of an initial POE survey

- E. Development of a final survey based on feedback from university administrator interviews and surveys of occupants
- F. Presentation of the POE findings from the case study facilities

1.5. Research Methodology

The methodology for this study included a review of literature related to post occupancy evaluation, project performance evaluation, post-construction evaluation, and occupant-satisfaction; all with a focus on functional and indoor environment performance of university work spaces. Based on the literature review, the need for this study was established. From the literature, it appeared that universities would benefit from conducting post occupancy evaluation surveys that would assess occupant satisfaction with functional and indoor environmental performance characteristics of renovated facilities in university office settings. This was followed by interviews with university owners, administrators, staff, and architects to confirm the need for this study and to gather insights and recommendations for use in developing the survey.

The interview responses were mainly used to identify the functional and indoor environmental aspects that affect faculty and staff satisfaction and that should be included in the evaluation of university work spaces. The interviews also sought to determine perceptions of: (a) the reliability of building occupants in building performance evaluation, (b) the identification of the person who should be responsible for conducting post occupancy evaluations, (c) the acceptable costs for conducting evaluations, and (d) the formats and resources that would be most effective.

Using the information from the interview responses, a post occupancy evaluation survey was developed and distributed to university owners, administrators, and staff for review and pilot testing. Based on feedback, the survey was further refined and converted into the web based format. Occupants from renovated facilities at Michigan State University were contacted and requested to participate in the POE survey. The survey addressed both building specific questions and also questions that sought feedback from respondents about the form, structure, and POE questions in order to gain user feedback on the survey. From the survey responses, revisions were made to the trial survey and the final form is presented in chapter 5.

1.6. Research Scope and Limitations

The focus of this study was the assessment of occupant satisfaction with regard to functional and indoor environmental performance evaluation of renovated office spaces in universities. Aspects that were excluded from the research scope are as follows:

1. Universities accommodate various functional areas for various population groups including students, faculty, and staff. This study was directed to staff and faculty work spaces and office areas. Other specific student areas such as classrooms, libraries, laboratories, studios, and conference rooms; common areas such as cafeterias, auditoriums, restaurants, parking ramps, outdoor interaction spaces, toilets, storage areas, and student lounges have been excluded. It is recommended that the methodology and survey developed and used in this study be further validated and modified for evaluation of other identified areas.

2. Building performance evaluation may be conducted to assess different aspects such as functional, technical, indoor environment, and maintenance. Also, evaluations may be conducted at different stages in the life cycle of a building, such as the programming, planning, design, construction, and occupancy phases to determine the different components related to the existence of a building. This study focused on the functional and indoor environment aspects; other aspects are excluded from the scope. This study is most suited to the occupancy phase since the functional and indoor environment evaluations would be incomplete without the inclusion of occupant perception.
3. The literature review indicated that building performance assessed from the perspective of owners, administrators, and managers was different from the perspective of building occupants. The order of priorities is different between the two groups even though the set of parameters may be the same. This study incorporated the perspective of the building owner group within the evaluation criteria and captured the feedback and satisfaction of the occupant group to gauge the effectiveness of the building design and operation.
4. Most large universities have future master plans that include new construction projects and periodic remodeling and renovation of existing facilities. This study was directed towards renovation projects within universities.
5. The post occupancy evaluation criteria for this study was established qualitatively based on literature review and responses from the exploratory administrator interviews that were conducted among university owners, administrators, staff, and

- architects. It is recommended that further research be conducted using quantitative methods to verify the evaluation criteria.
6. The developed survey was tested in two renovated facilities within one university. To enhance and validate the survey, it should be tested in more facilities within the same or other universities.

1.7. Research Deliverables

The primary product of this research is a customized survey to assess occupant satisfaction with regard to functional and indoor environmental performance of renovated work spaces in university settings, and also to determine staff and faculty preferences. Other deliverables of this research are as follows:

1. Literature reviewed and presented with regard to the post occupancy evaluation of university office environments and identified future research areas
2. Evaluation criteria identified and presented to assess functional and indoor environmental quality of university offices
3. An interview questionnaire for university owners, administrators, staff, and architects to gain insights and identify evaluation criteria to assess occupant satisfaction with regard to functional performance, indoor environment design, and the operation of renovated facilities in university settings
4. A standard methodology for developing customized surveys to assess functional and indoor environmental performance of other types of buildings using occupant perception

5. An analysis of case study facilities and an assessment of their performance for staff and faculty focusing on functions performed and indoor environmental quality

1.8. Chapter Summary

This chapter presented an overview of post occupancy evaluation, followed by a discussion of the project need, the research goal, and objectives. The research scope and limitations explained in this chapter provided direction for future research. Finally, this chapter contended that this current study will help university organizations identify the elements of the physical work environment that will enhance the work experience of the staff and generate higher satisfaction and productivity levels. The process and survey will help facilitate a periodic dialogue between the building occupants and managers about their environmental needs and preferences.

This chapter is followed by Chapter 2, which presents the review of literature. Chapter 3 presents the research method, Chapter 4 presents the data collected and analyzed, Chapter 5 presents the modified POE survey, Chapter 6 presents the POE process, and Chapter 7 presents the findings of the overall project, recommendations, the project summary, and conclusions.

CHAPTER 2

LITERATURE REVIEW

2.1. Chapter Overview

Chapter two presents the summary of the literature reviewed for this study, which has been divided into three sections as shown below in Figure 2.1. The first section, “Section 2.2: Post Occupancy Evaluation”, discusses the fundamentals of POE. The second, “Section 2.3- Post Occupancy Evaluation Factors”, presents the various functional and indoor environment evaluation factors found in literature and their relation to workplace productivity and occupant satisfaction. These were used to identify the evaluation factors for this study. The third section, “Section 2.4- Post Occupancy Evaluation: Application”, presents similar studies found in the literature that include post occupancy evaluation. This literature was used to identify successes and failures of methodology and to derive insight in order to minimize obstacles and challenges, which might have otherwise been experienced by this study.

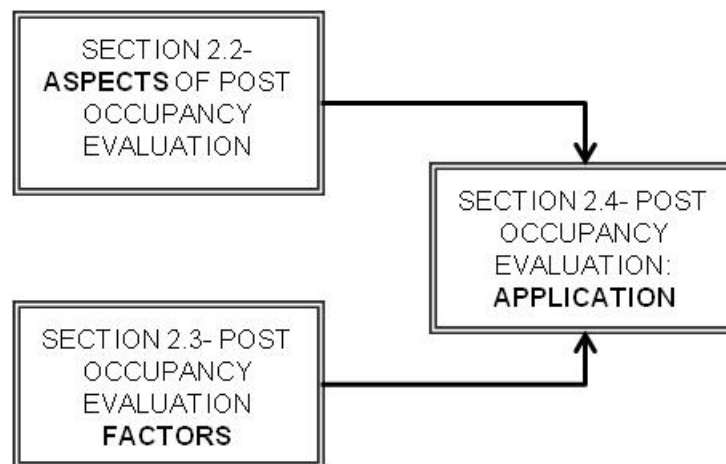


Figure 2.1: Literature Review Structure Overview

As shown above in Figure 2.1, the information presented in the first section (2.2) and second section (2.3) are vital in order to thoroughly understand the information and discussion presented in the third section (2.4) with regard to the application of POE. As shown below in Figure 2.2, Section 2.2: Post Occupancy Evaluation presents the different levels, benefits, phases and dimensions of POE, which provides the rationale for the POE focus, scope, and limitations in this study; Section 2.3: POE factors present the various studies that were used to identify the evaluation factors pertaining to the scope of this study; and, Section 2.4: POE: Application presents a discussion of the various existing POE processes reviewed in order to develop a tailored POE process for this study.

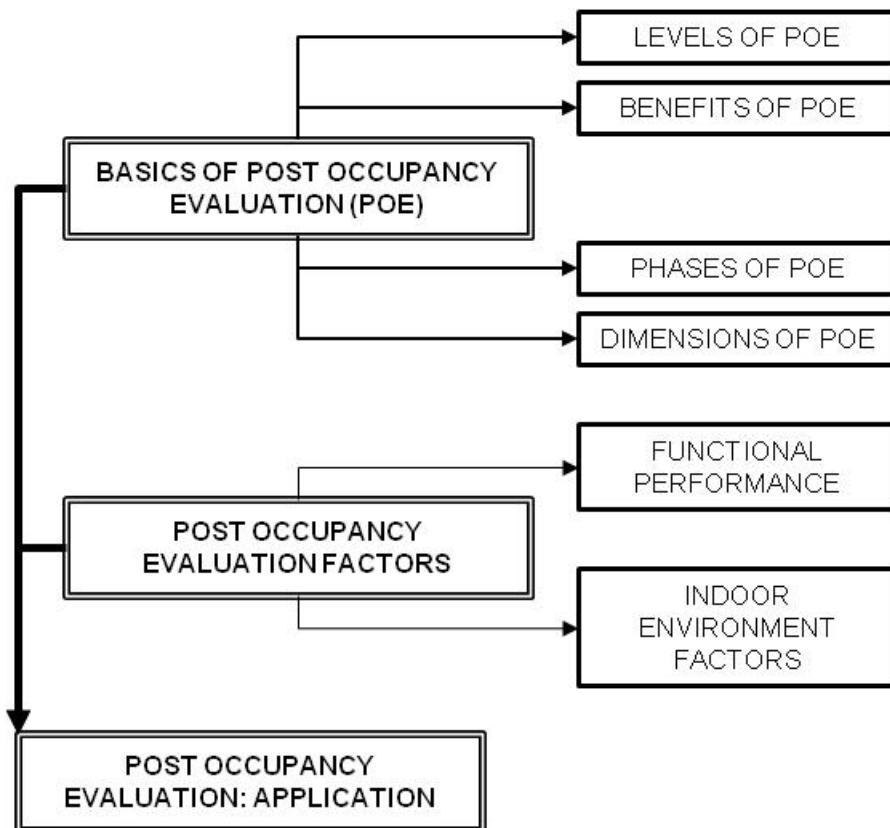


Figure 2.2: Detail Structure of Literature Review

2.2. Post Occupancy Evaluation

POE is an outcome of a culmination of interests among social scientists, spatial designers, and planners in the 1960s and 1970s. It originated in the United Kingdom and spread to the United States of America, Australia, New Zealand, and several developed nations. By the 1980s, it had significantly advanced in theory, method, strategy, and applications; it became the focal point for discrete research areas such as the built environment, facility management, and building delivery process. Since then, studies have been conducted to identify the diversity and variety in the application of POE (Preiser 1988; Zimring 2001; Kooymans and Haylock 2006).

POE has multiple definitions that represent different facets. Two definitions that are considered for this study are as follows: POE is an examination of the effectiveness of occupied built environments for human users that focuses on the assessment of occupant satisfaction and functionality of space; where, “effectiveness” corresponds to the achievement of personal and organizational goals by the enhancement of physical and organizational factors (Bechtel and Srivastava 1978; Brill 1974; Friedmann et al. 1978; Gutman and Westergaard 1974; Ostrander and Connell 1975; Brooks and Viccar 2006; Zimmerman and Martin 2001). “POE is measurement of building performance throughout the life cycle of building from initial concept through occupancy such that the information gathered is used to improve future building designs” (Marans 1984; RIBA 1991; Shibley 1995; Duffy 2000; RIBA 1991; MARU 2001; Vischer 2001; Zimmerman and Martin 2001; Preiser 2002 as mentioned by Carthey 2006; AUDE and HEDQF 2006; Preiser 2008).

The literature suggested that post occupancy evaluation refers to evaluation conducted after the occupancy phase and is different from other evaluations relevant to other phases of “the building life cycle”. “The building life cycle” is comprised of the following six phases: planning, programming, design, construction, occupancy, and recycling. Each of these phases has corresponding assessments, namely: effectiveness review, program review, design review, post construction evaluation, post occupancy evaluation, and market analysis respectively. POE focuses on evaluation when the building is occupied.

POE differs from other building evaluations in four ways (Preiser 2001, 2002). First, the evaluation target is building performance from the occupants’ point of view. Second, an evaluation criterion comes from the stated design criteria. Third, the main measure in POE is the occupants’ perception and satisfaction, and whether the designed environment supported their ability to perform. Fourth, POE can include various issues about functionality of the environment as well as the occupants’ satisfaction based on their psychological and social needs due to the method that involves human subjects.

As shown below in Figure 2.3, this section presents a discussion of levels, benefits, phases, and dimensions of POE which provide the background and rationale for the research project scope and limitations. The information provided by “Section 2.2: Post Occupancy Evaluation”, in addition to “Section 2.3: Post Occupancy Evaluation Factors”, leads to a better understanding of the existing POE application methods and the one used for this study.

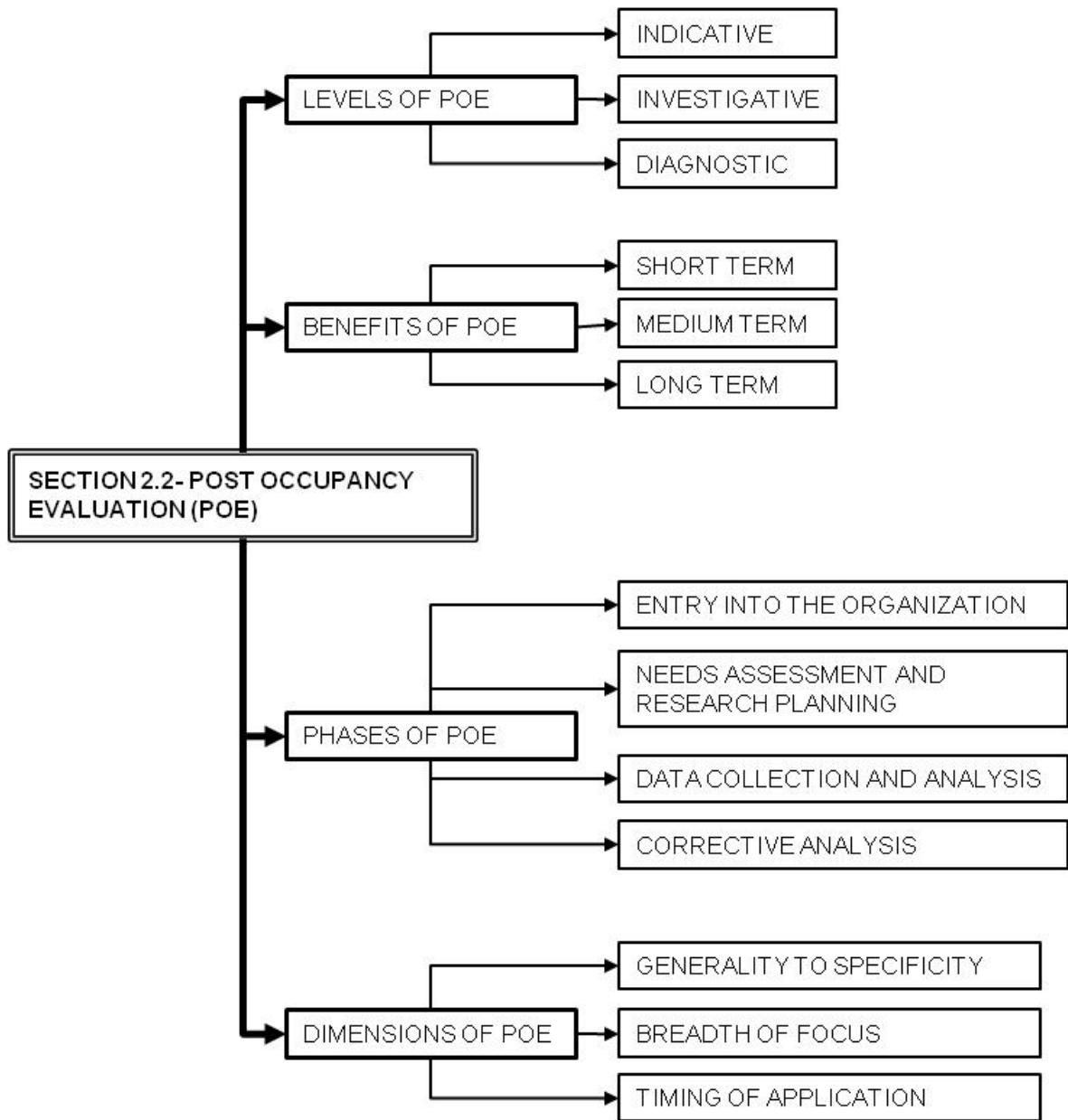


Figure 2.3: Structure of Section 2.2: Post Occupancy Evaluation

2.2.1 Levels of Post Occupancy Evaluation

There are three levels for POE as shown below in Table 2.1, which have been summarized in Table 2.1. The first level is indicative if the building under consideration has issues; the second level is investigative, which focuses on the specific issues if there are any; the third level is diagnostic, which comprises of corrective actions to the issues

identified (Preiser 2002; Carthey 2006; AUDE and HEDQF 2006). These levels are based on the purpose of conducting the evaluation and availability of resources such as budget, time, and work force (Carthey 2006; Preiser 2002; Brooks and Viccar 2006).





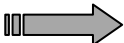

		Phase I	Phase II	Phase III
Level of Effort	Level I: Indicative	Planning 	Conducting 	Applying
	Level II: Investigative	Planning 	Conducting 	Applying
	Level III: Diagnostic	Planning 	Conducting 	Applying
Steps		1.1- Reconnaissance and feasibility 1.2- Resource Planning 1.3- Research Planning	2.1- Initiating on-site data collection process 2.2- Monitoring and managing data collection procedures 2.3- Analyzing data	3.1- Reporting finding 3.2- Recommending actions 3.3- Reviewing outcomes

Table 2.1: Levels of Post Occupancy Evaluation (Preiser 1995)

The next three paragraphs are based on the discussions from Preiser 2002 on the three levels of POE which affect application efforts and costs.

Indicative level POEs usually present an overview of building performance. It usually involves an interview with the facility owner or manager, accompanied by a walk-through to record the positive and negative aspects of building performance. The evaluator may also use graphic images or photographs to substantiate physical observation. Typically, the time required for this level of evaluation depends on the size and complexity of the facility. A 10,000 square foot facility can be completed in less than

half a day by a team of one to three persons who are familiar with the building type under consideration.

Investigative level POEs require more involvement from the evaluators; more rigorous evaluation techniques are employed to produce more reliable data compared to the first level. Investigative POE must be preceded by an indicative POE; such that a detailed evaluation is carried out of particular problems within the building in general. For this level, the results from the indicative study are incorporated in survey questionnaires, which are administered to building occupants at all levels of the organization. A study conducted by Preiser in 2002 indicated the cost of investigative POE ranged from USD 1.00 to 2.50 per square foot for large and complex organizations up to 15,000 square feet. This type of POE can extend over several weeks and months depending on depth of investigation if the study involves evaluation through different periods or seasons.

Diagnostic level POEs are most intense reviews of building performance that correlate and verify the physical performance data with occupant responses. These consume the maximum resources in terms of time, money and labor among the other two levels. Per a study conducted by Preiser 2002 with focus on POE levels, diagnostic POEs cost more than USD 2.50 per square foot and extend over longer durations as compared to the other levels. The outcomes of this level of POE conducted across comparable facility types and sizes, thereby acquiring highly generic and valid data over a period of time will have great value and potential to transform into guidelines for organizations. According to the same study, it was also found that federal agencies reported costs ranging from USD 1800 for a simple standard questionnaire that could be completed in

one hour to USD 90,000 for an in-depth survey analysis, including several days of interviews and use of multi-disciplinary teams, site visits and report writing.

Table 2.2 shown below presents the summary of POE levels with regard to methods that may be employed, time that is required and general comments assembled by Brooks and Viccar in 2006:

POE LEVELS	AIMS	METHODS	TIME SCALE	COMMENTS
Indicative	Assessment by experienced personnel to highlight POE issues	<ul style="list-style-type: none"> ▪ walk through evaluation ▪ structured interviews ▪ group meetings with end users ▪ general inspection of building performance ▪ archival document evaluation 	Short Inspection period	<ul style="list-style-type: none"> ▪ Quick, simple, not too intrusive/ disruptive to daily operation of building. ▪ Judgmental and overview only.
Investigative	In-depth study of building's performance and solutions to problems	<ul style="list-style-type: none"> ▪ Survey Questionnaires ▪ Interviews ▪ Comparison of results with similar facilities ▪ Report appropriate solutions to problems 	One week to several months	<ul style="list-style-type: none"> ▪ In-depth/ useful results ▪ Can be intrusive/ time consuming depending on the number of personnel involved
Diagnostic	Show up any deficiencies (to rectify) and collect data for future design of similar facilities	<ul style="list-style-type: none"> ▪ Sophisticated data gathering and analysis techniques ▪ Questionnaires ▪ Surveys ▪ Interviews ▪ Physical measurements 	Several months to several years	<ul style="list-style-type: none"> ▪ Greater value in usability of results. ▪ More time consuming

Table 2.2: Levels of Post Occupancy Evaluation (Brooks and Vicar, 2006)

In the current thesis study, the level of POE that has been delved into is partly indicative and partly investigative. The level of occupant satisfaction is considered as a dependent variable which indicated if the targeted/ desired performance for the renovated building has been achieved with regard to office layout, storage space, thermal comfort, air quality, etc which were considered as independent variables and broadly categorized as functional and indoor environmental performance aspects. The methods used are interviews and surveys which were conducted in two stages/ phases during the study. The purpose of the interviews was to capture perception of owners, administrators, managers and designers and surveys to capture perception of occupants.

2.2.2 Benefits of Post Occupancy Evaluation

Considering the costs associated with conducting post occupancy evaluations, the returns/ benefits are significant but specific to the stakeholder (AUDE and HEDQF, 2006; Watson, 1996; Baird et al. 1996 as in Carthey, 2006; Preiser, 2002). The short, medium and long term benefits of POE for stakeholders are summarized in Table 2.3.

The POE benefits to this current thesis study are three-fold. One, the owner group received first-hand information of the occupant's (faculty/staff) level of satisfaction or dissatisfaction with respect to their work-space, which is a strong motivational factor towards staff productivity and retention; two, occupants were able to contribute to identifying ways to improve the performance of their work-space; three, designers of renovated facilities could be informed of the pros and cons of their design on building users. These benefits are specific to each stakeholder.

The method developed will provide for university owners to save on a technical evaluation which is more expensive and appropriate for conducting detailed investigation if occupants were found to be dissatisfied with their facility. This method provides occupants with an opportunity to express their grievances and appreciation towards their personal workspace confidentially. This approach increases the chances of feedback being more frank and genuine. This method also provides designers with feedback on the performance of their designs without application of additional resources and efforts.

Stakeholders	Short term benefits	Medium term benefits	Long term benefits
Owners Administrators Managers	<ul style="list-style-type: none"> • POE helps identify problems and solutions in design and operation of buildings within a year from substantial completion • POE helps test new building design concepts and technology soon after application/ installation • POE is a proactive approach on part of facility owners, managers with focus on user needs which, impress users 	<ul style="list-style-type: none"> • POE is conducted periodically, therefore it captures changing functional needs of building occupants and since it involves occupants, there is minimum conflict from users in later stages • POE tracks flexibility of building towards organizational growth or change • POE tracks building performance on a regular basis, the information gathered can be used to justify large investments • POE helps maintain maintenance records which keeps building managers informed of the next scheduled maintenance. 	<ul style="list-style-type: none"> • POE serves as a continuous-measurement and improvement tool in facility management and measure overall performance of buildings • POE, with all the information that it can extract over a period of time may be used to prepare or update master plans for universities • Improved staff-productivity and satisfaction • POE database could contribute to generate and improve planning, design guidelines and construction standards

Table 2.3: Benefits of Post Occupancy Evaluation
(Brooks and Vicar, 2006)

Table 2.3 continued: Benefits of Post Occupancy Evaluation
(Brooks and Vicar, 2006)

End users	<ul style="list-style-type: none"> • POE extracts first hand information on specific user needs • POE helps improve space utilization through feedback directly from users 	<ul style="list-style-type: none"> • POE generates improved attitude and productivity • POE enables users to inform managers about building issues experienced 	<ul style="list-style-type: none"> • POE generates improved attitude and productivity • POE facilitates periodic communication between users, and building managers
Project team/ designer	<ul style="list-style-type: none"> • POE enables designers and managers to fine-tune design and operation of substantially complete buildings • POE enables designers to receive first hand feedback from users of new design concepts that may have been used in the renovation of a building or work space 	<ul style="list-style-type: none"> • POE lead to an improved relationship between designers, managers and building occupant • POE investigates if the intent of the design program was achieved as planned by measuring space/ building performance using various parameters such as functional performance, indoor environment quality, health and well-being, productivity and satisfaction of occupants. 	<ul style="list-style-type: none"> • POE becomes a process of 'lessons learnt' for designers and thus help them build and update their design library of successful or unsuccessful features • This information gathered from POE over a period of time will enhance designers knowledge and thus ability to make more efficient designs

2.2.3 Barriers to Conducting Post Occupancy Evaluation

This section flows from the discussion of POE benefits in the previous section. Since all stakeholders benefit from POE, it becomes difficult to decide who will bear the responsibility for corrective action and cost of evaluation.

Designer's perspective: In spite of being co-benefactors, there is very little incentive for designers to bear costs or consider making POE part of the standardized approach due to the notion that they may be blamed for problems in the building. These problems may be due to design follies but they may also be due to lack of communication, maintenance or proper use on the part of the occupants.

Owner/Client's perspective: The owners may not be in favor of getting their building evaluated due to the concern that the building value may depreciate if problems are discovered. This is also followed by the responsibility of having to take corrective measures which may be costly. Often, owners are also concerned about revelation of unwanted facts or expression of extreme emotions on part of the occupants during the evaluation. In a university setting, there are many levels of hierarchy in authority and decisions may be made by an individual at a higher level but the occupants may consider the person communicating the decision responsible for their dissatisfaction if it does not serve their interests.

Facility Manager's perspective: As for facility managers, they may not be willing to spend their time, effort and resources to conduct a process unless convinced of cost-effectiveness and deliverables that will improve performance of the facility and thereby satisfaction and productivity of occupants.

In the current research study, 90% of the interview responses from university owners, administrators, managers and architects confirm that they believe POE to be highly useful in assessment and improvement of building functional and indoor environment performance.

2.2.4 Phases of Post Occupancy Evaluation

The Keys and Wener 1980 study defined that POE can be conducted without impediment by addressing issues specific to the four phases of POE and helps to systematically tackle intervention at various levels of organization hierarchy, to avoid waste of efforts made by evaluator teams to ensure actual application of the process as planned and to maximize acceptance of recommendations and suggestions for corrective actions derived from the process amongst all stakeholders. The four phases are presented in Figure 2.4.

The first phase- **“entry into the social system”** refers to the researcher’s first attempt to contact the client organization. Two main issues in this phase are the need for project-support from all hierarchy levels of client organization and pre-history of POE. The Keys and Wener 1980 study suggested that higher levels of organizational hierarchy have a more pronounced control over project initiation as compared to the lower levels that has subtle control over project execution; especially when there may be a doubt on management’s motive for allowing or conducting POE. Prehistory of POE refers to the events that occurred in the organization prior to POE start that have significantly affected the relationship between the different population groups or levels. The intervention issues were prevented in this thesis study by participant-involvement and consensus using thorough communication with all levels of client organization and informing them of the purpose and process of this evaluation and encouraging all to provide input to make it most allied and efficient for the entire organization.

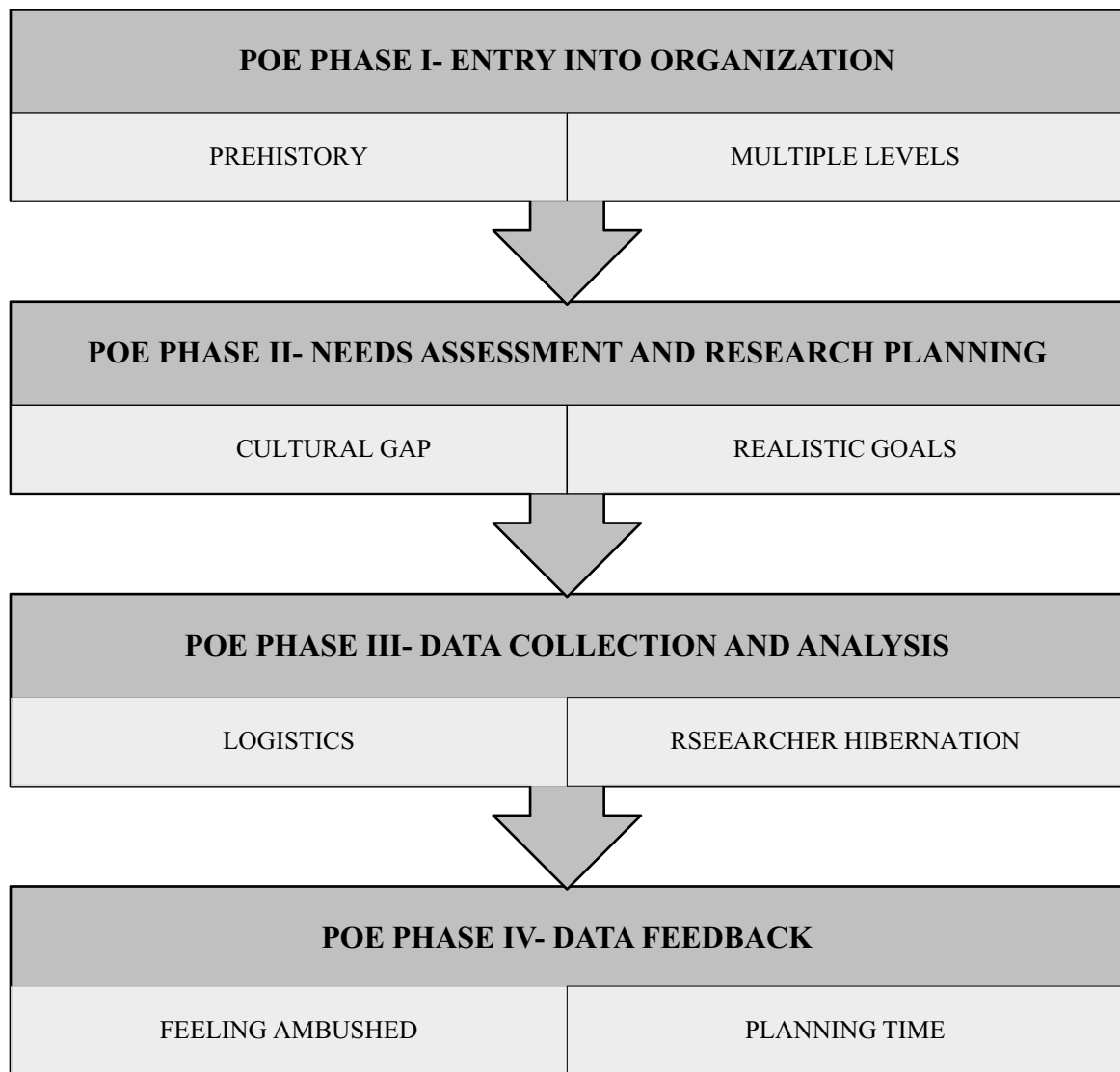


Figure 2.4: Phases of Post Occupancy Evaluation
(Source: Keys and Wener, 1980)

In the second phase- **“need assessment and research planning”**, project need, plan of action and project deliverables are decided. The Keys and Wener 1980 study suggested that POE can be conducted by researchers for organizations to maintain a nonbiased approach. During the second phase the issue may be the difference between researcher’s academic setting and client’s organizational setting. This difference is often client’s lack of knowledge of efforts that go into a POE process. Interviewed subjects or

administrators may have suggestions that may have potential for future research but may not work if all ideas are used in one process. This is because the purpose of POE can vary based on the desired outcome. At this point, the client must be informed of limitations associated with time, efforts and resources and thereby set realistic and project specific goals. Since this is a research study there were no real clients but the researcher kept the case study organization informed through all phases of the POE process.

The third phase- **“data collection and analysis”** during which, challenges experienced may be minimized by making use of a good working relationship with client organization administrators and staff. Once the data are successfully collected, the researcher begins analysis. It is during this phase that, “Researcher hibernation” causes client suspicion which may be avoided by keeping the client organization updated with the progress of data analysis.

The fourth phase, **“Data feedback”** is crucial to the researcher’s future relationship with the client organization and the inter-personnel relationships within the client organization. The researcher must provide feedback such that when findings are presented in a group situation, those that are most affected must be informed in advance, particularly if the findings are negative. This gives everyone time to prepare their responses for a group presentation. Usually these individuals are authorities at the client organization and are most vulnerable in a group. Also, there may be those, who are in positions that can influence the plan of action after the POE. The researcher can increase the probability that effective action be taken based on POE findings by setting aside sufficient time for the research findings to be considered by organization authorities.

In order to enhance the quality and impact of their POEs, the researcher must address the various issues through the different phases of the process. In the current thesis study, the last two phases of POE have been directly considered. The first two phases were incorporated in an informal manner. The different phases of the current study have been discussed in detail in chapter three: methodology.

2.2.5 Dimensions of Post Occupancy Evaluation

Three dimensions of POEs were discussed by Zimring and Reizenstein in 1980. The first dimension discussed was: **generality and specificity**, refers to the nature of the POE data collected. For example, a study based on impact of floor-plan configurations on users is driven by generic data collection, whereas a study based on specific apartment complex for quadriplegic adults is targeted towards specific settings.

The second dimension discussed by Zimring and Reizenstein in 1980 was: **breadth of focus** which refers to the extent of review during an evaluation. The focus of review can be a single physical characteristic of a single setting versus multiple settings. It can also be evaluation of holistic systems such as the social and physical workings of a combination of settings or influence of social trends on the organizational structure that operates in those settings.

The third dimension discussed by Zimring and Reizenstein in 1980 was: **timing of application** which suggested that while some studies can be conducted on a short term basis to inform design and planning decisions, some may be conducted long term to develop heuristics and facilitate future planning. Although most POEs have a primary

goal, a single study may have multiple goals or multiple studies may have a common goal.

The current research study focused on the functional and indoor environment performance of faculty and staff work-spaces in university settings especially for renovated projects which makes the focus of this POE specific in terms of the first two dimensions. With regard to the third dimension, this study is intended to assist universities and provide short and long term benefits. The method used in this study can be employed to conduct similar studies for other university settings such as classrooms, libraries, common areas, etc.

2.3. Post Occupancy Evaluation Factors

As mentioned in chapter one, since 1980s, POE has significantly advanced in theory, method, strategy and applications, and has become the center of attention and meeting point for discrete research areas such as, built environment; facility management; building delivery process, etc (Preiser 1988; Zimring and Rosenheck, 2001; Kooymans and Haylock, 2006). This phenomenon led to several studies that identified built environment characteristics that affect human behavior and comfort. The Keys and Wener 1980 study outlined the relationship between physical environment, organization setting of the workplace and staff perception and behavior as shown in Figure 2.5. These relationships were helpful in determining the POE factors for the current study.

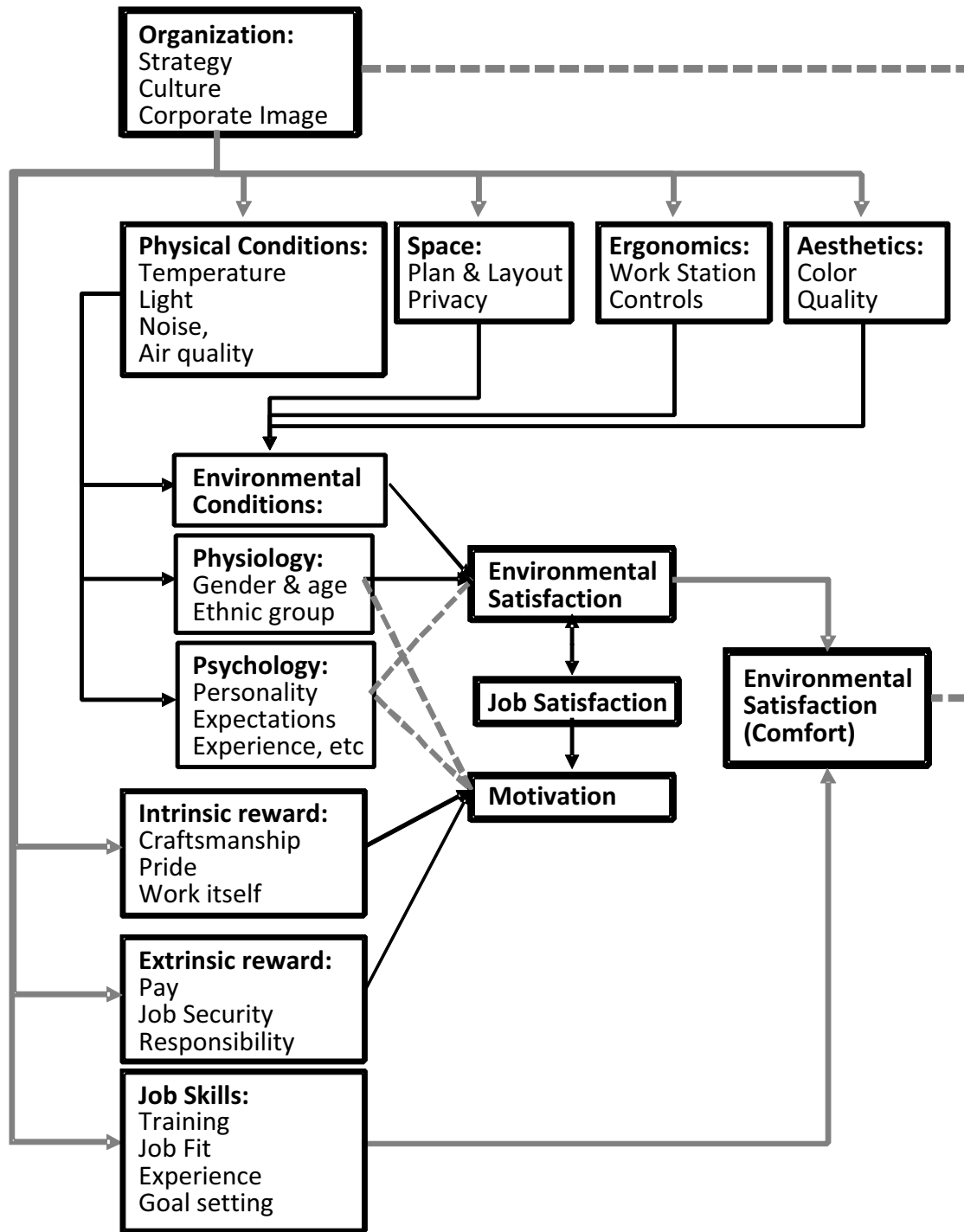


Figure 2.5: Relationship between Environment Conditions, Occupancy Satisfaction, Productivity and Motivation
(Source: Keys and Wener, 1980)

Studies by Kincaid (1994), Gonzalez et al. (1997), Bottom et al. (1997) and Tarricone (1999) identified factors that impact the functional performance and indoor

environments in offices which thereby influence staff satisfaction and productivity. These factors are summarized as follows: aesthetics, temperature, noise, air, space, lighting, storage, layout and circulation, adjacency of space, privacy, project management process, equipment areas, teaming areas, meeting spaces, construction quality, accessibility and user friendliness.

Horgen et al. study in 1996 at the Taubman Building of Harvard University's John F. Kennedy School of Government employed two methods: survey questionnaires and participatory workshops to assess user satisfaction and building performance of recently occupied and remodeled buildings. The study concluded that user satisfaction was a strong performance indicator for facilities with regard to environment factors such as air quality, thermal comfort, heating, ventilation and air conditioning, spatial arrangements, furnishings and materials used for office interiors.

Since 2000, several other researchers investigated these physical environment factors such as privacy, lighting, storage, and thermal comfort for their impact on staff productivity and concluded that good quality built environment, work processes and work culture has positive influence on staff productivity and satisfaction in organizations (Leaman, 2003; Bordass & Leaman, 2005; Preiser, 2002; Way & Bordass, 2005; Kooymans & Haylock, 2006; and, Brooks & Viccar, 2006).

The functional and indoor environment factors identified from the different studies mentioned in the above paragraphs were used to determine evaluation factors for this thesis study. The next two sections present the description of each of these functional and environmental factors.

2.3.1 Functional performance evaluation factors

For the purpose of this thesis study, the functional evaluation factors have been defined with regard to the literature reviewed (Tarricone 1999, Bottom et al. 1997, Gonzalez 1997, Kincaid 1997, Farrenkopf and Roth 1980, Proceedings of Healthy Buildings 2006) and the interviews conducted as follows:

1. **Office Layout-** refers to the placement and orientation of office components such as furniture, equipment, storage units, reference material, user-seating, etc with relation to the physical space, such that their design enhances the temperament and productivity of the office-occupant.
2. **Location of Work Space or Office-** refers to the placement of a particular work area or room occupied by an individual in relation to the bigger work area or room or building occupied by a group of individuals such that they belong to the same unit or department or organization.
3. **Amount of Space-** refers to the availability and sufficiency of space due to work-space design for an individual such that they can comfortably conduct their work responsibilities.
4. **Ease of Interaction with Co-workers-** refers to that aspect of work-space design which enables and facilitates office users to socialize to an extent that it benefits and not hampers their work responsibilities.
5. **Privacy-** refers to the ability of office users to feel sufficient personal space such that they can comfortably conduct their work responsibilities and not feel either too lonely or crowded. This feature has two aspects: visual privacy and sound

privacy. Sound privacy seems to be of greater importance for office-occupants than visual privacy.

6. **Office Furniture and Furnishings-** refers to the quality, make, design, look and overall feel of the furniture and furnishings that are present in an individual's work-space which influence the temperament and productivity of office-occupants.
7. **Office Equipment-** refers to computers, printers, phone, fax, copier or scanner, etc, which is instrumental in completing the respective work responsibilities of office-occupants.
8. **Accessibility-** refers to the ability of office-occupants to easily travel from the parking to their individual work-space without any obstacles.
9. **Access and Ability of Personal Control-** refers to the ability and flexibility given to an individual to control their personal work-space internal environment aspects such as temperature, humidity, noise-control, light-control, etc. Personal control over environmental conditions (e.g., thermostat or operable window) has a significant positive impact on occupant satisfaction. One means of achieving higher occupant satisfaction would be to provide such control to more occupants.
10. **Window Location and View-** refers to the presence or absence of an external window in an individual's work-space and how it may impact their temperament and productivity.
11. **Renovation Process-** refers to the overall process of building renovation, which includes project phases starting from the program-phase, plan, design,

construction, and up to occupancy. This factor includes any and all the good and bad experiences that office-occupants may have had during any of these phases.

12. **Construction Quality**- refers to the perceived quality of construction based on the experience of the office occupants.

2.3.2 Indoor Environment Evaluation Factors

Building occupants are a rich source of information about indoor environmental quality and its effect on comfort and productivity (Zagreus et.al, 2004). The following indoor environment evaluation factors have been identified based on the literature reviewed.

1. **Lighting** (Menzies & Wherrett, 2004) - refers to the natural and artificial lighting that is present in an individual work-space. It includes the quality, intensity, flexibility to adjustment (quantity) available to office-occupants. Daylight levels, lighting and glare have previously been found to be very important in determining comfort and productivity in the workplace.
2. **Thermal Comfort** (Olesen and Brager, 2004) - Thermal comfort is essentially a subjective response, or state of mind, where a person expresses satisfaction with the thermal environment. While it may be partially influenced by a variety of contextual and cultural factors, a person's sense of thermal comfort is primarily a result of the body's heat exchange with the environment. This is influenced by four parameters that constitute the thermal environment (air temperature, radiant temperature, humidity and air speed), and two personal parameters (clothing and activity level, or metabolic rate). People may be dissatisfied due to general (whole

body) thermal comfort and/or due to local (partial body) thermal discomfort parameters (radiant asymmetry, draft, vertical air temperature difference, and floor surface temperature). Presently, no methods exist for combining the percentage of unsatisfied people due to various factors to give an accurate prediction of the total number of people finding the environment unacceptable. For example, we don't know if the dissatisfaction resulting from general thermal discomfort is additive with the percentages of those who are dissatisfied due to local discomforts, or whether the total dissatisfied may be less than the sum of the individual percentages (i.e., some people complaining about more than one particular problem simultaneously).

3. **Air Quality** (Proceedings of Healthy Buildings 2006) - refers to the indoor air quality that the university office occupants are subjected to on a daily basis. The different IAQ aspects identified as perceived by occupants are: “air is stuffy and stale”; “air is not clean”; “air smelling bad (odors)”. The three most frequently identified sources of odor are food, carpet or furniture, and other people. ASHRAE Standard 62.1-2004 defines acceptable air quality as conditions in which more than 80% of people do not express dissatisfaction.
4. **Acoustics** (Jensen et al. 2005) - acoustics is an important attribute of commercial office building design, that noise is probably the most prevalent annoyance source in offices and can lead to increased stress for occupants. Speech privacy may have a more significant effect than noise and yet, acoustics in most cases do not receive the same level of design attention as thermal, ventilation and other architectural and engineering considerations. The causes and consequences of poor acoustical

performance are perhaps not adequately understood by designers and building owners. It would therefore be valuable to determine from a large population of office buildings how occupants perceive their acoustical environments, and what aspects of office building design are influencing these perceptions.

2.4. Post Occupancy Evaluation: Application

Three significant studies were identified during the literature review, which discuss the POE process. All these three studies have been jointly helpful towards development of the POE process followed in the current thesis study. This process is presented and elaborately discussed in Chapter Six, “Post Occupancy Evaluation Process”. The next three paragraphs present a discussion of the individual process steps from the three studies: Preiser 2002, NSW Treasury 2004, and AUDE&HEDQF 2006 followed by a brief discussion of the common steps.

The Preiser 2002 study, as shown in Figure 2.6 identifies 3 phases and 9 sub-phases in a POE process. The first phase: ‘planning’ involves review for feasibility, and planning for the resources and the research that may be needed for a particular level of POE. The second phase: ‘conducting’ starts with collection of data from the evaluation site which is followed by the analysis of the collected data. The third phase: ‘applying’ involves documentation of the results and suggestion of corrective action based on the results.

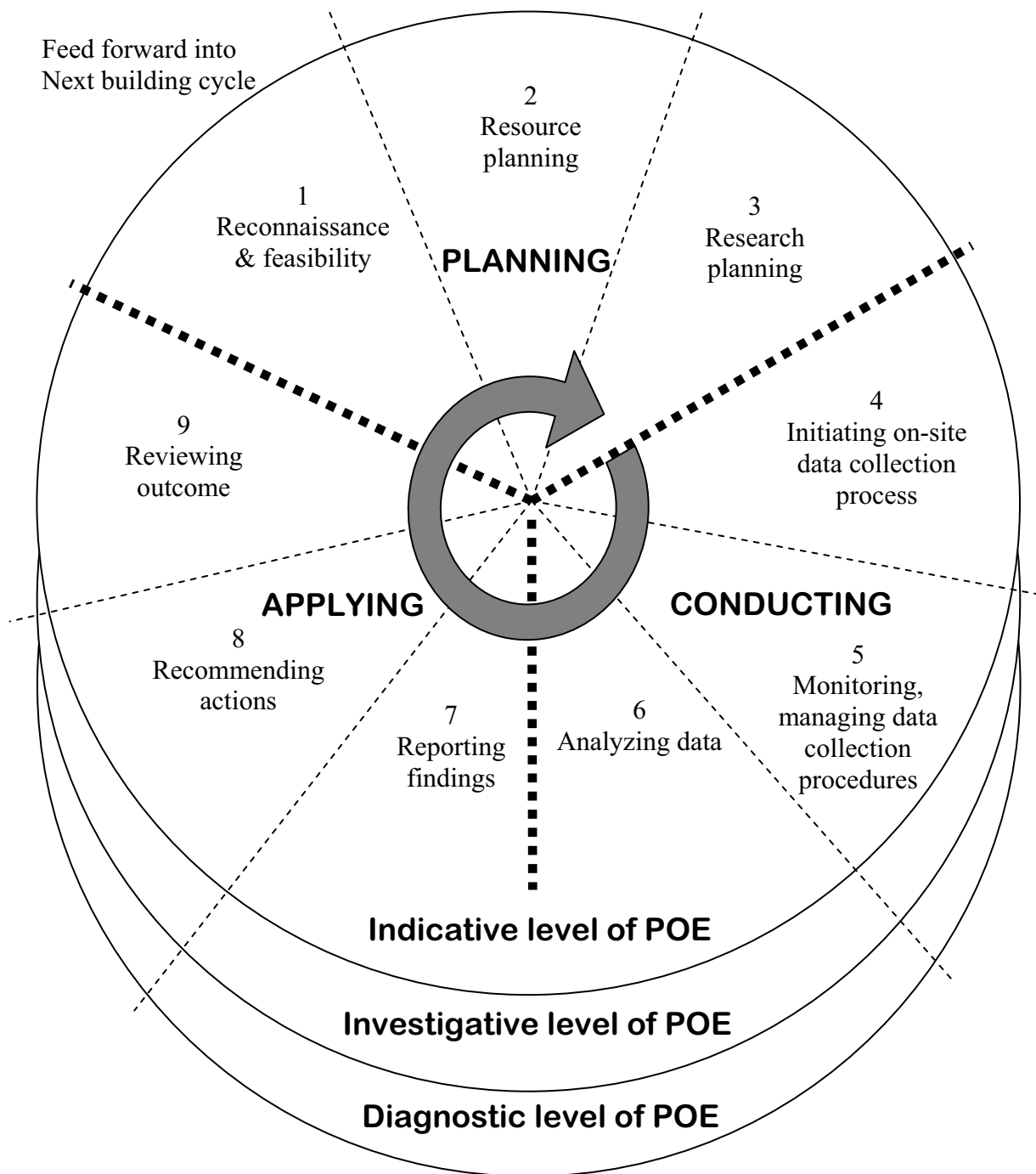


Figure 2.6: Phases of POE
(Source: Preiser, 2002)

The NSW Treasury 2004 study outlined a PIR (post implementation review) process that consists of seven steps as shown in Figure 2.7. The first step is to establish the objective and structure of the review which lays the grounds for the

following steps: further research, resource allocation, and evaluation framework development. Once the framework is ready, the next steps are to collect data, conduct analysis and comparison of data, identify major issues, report findings, and finally provide findings to generate feedback.

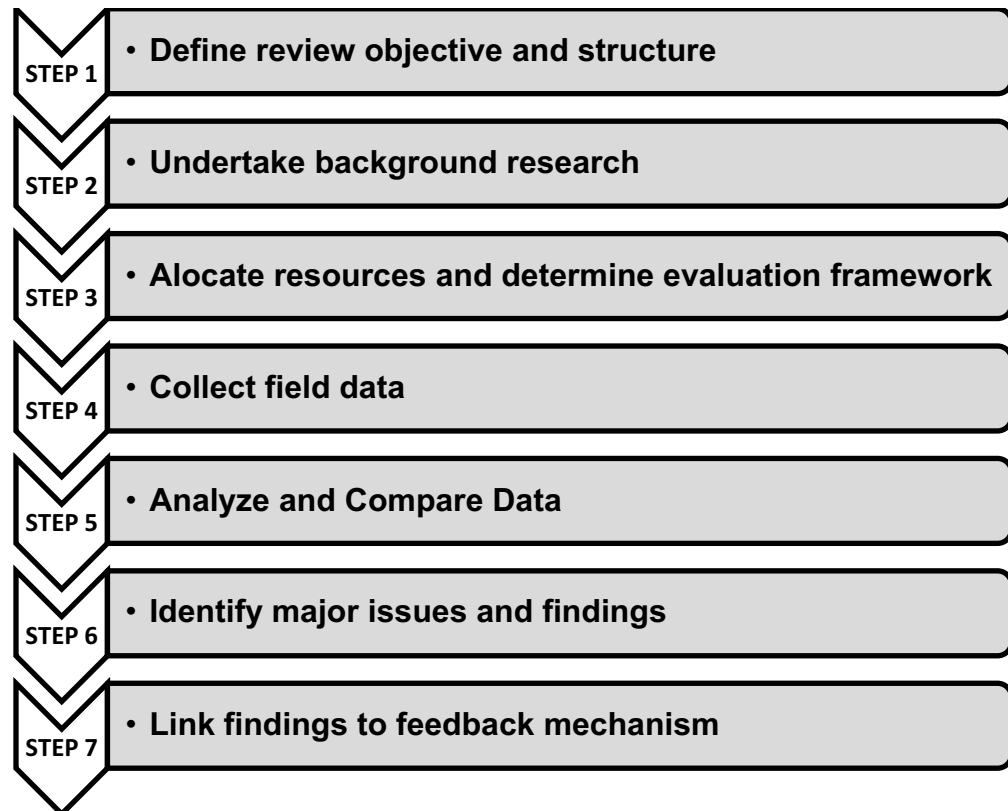


Figure 2.7: Post Implementation Review Process
(Source: New South Wales Treasury, 2004)

The AUDE & HEDQF 2006 study laid out a seven step process similar to the NSW Treasury 2004 PIR process as shown in Figure 2.8. The first step is to identify the need and the probable aspects for the evaluation. The second step is to identify which issues the evaluation must address and whether it will be carried out internally or by external consultant. The third step is to succinctly define the purpose of the POE and how it is to be achieved. The fourth step is to select approaches that will meet your needs. The fifth step is to distribute and collect survey questionnaires, carry out interviews, meetings

and observations. The sixth step is to prepare a report containing feedback from findings. The last step is to develop an action plan in response to POE results, which will feed information into university policies and into future projects.

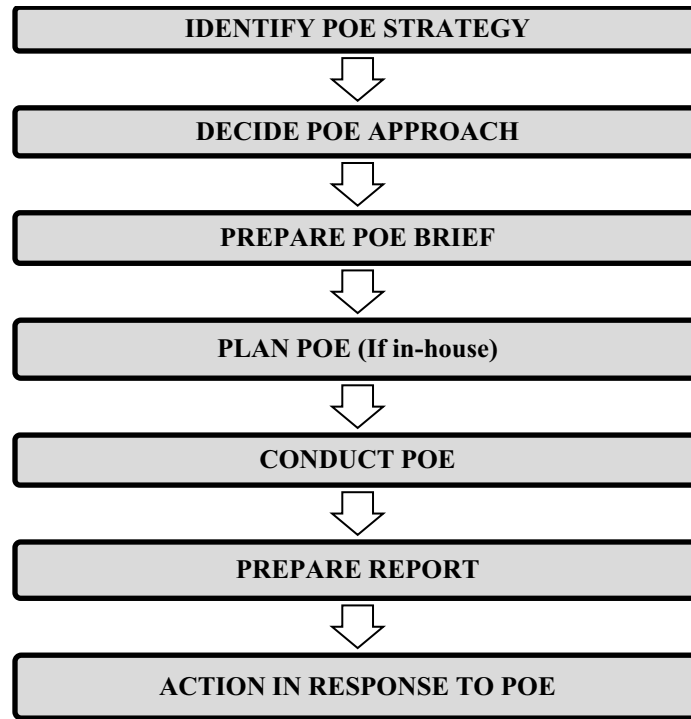


Figure 2.8: POE Process Overview
(Source: AUDE and HEDQF, 2006)

The above mentioned three processes can be summarized in the following common steps: review feasibility, plan process, identify level of effort, allocate resources, collect data, analyze data, report findings, and recommend corrective actions. These steps were salient in the development of the applied POE process in the current study.

2.5. Post Occupancy Evaluation Instruments

Two studies: Brooks and Viccars, 2006 and AUDE 2006 compared existing POE instruments to outline their advantages, disadvantages, most suitable timing of application, suitable scope, usefulness, and level. The findings of the two studies are

presented in Tables 2.4, 2.5, and 2.6. Partial information in these tables is employed in the current study and is indicated in bold.

METHODS	ADVANTAGES	DISADVANTAGES	USEz in POE	COMMENTS
Walk-through survey	Cheap and simple	Can be too judgmental and subjective	Yes	Essential for technological review of systems
Diary Analysis	Detailed data over time	Hard to administer. Respondent's response flags. Data intensive	Only if no other alternative	
Focus Group	Cost effective; Picks up details left out by questionnaires	Needs skilled facilitator	Yes	Especially for design team review
Individual interviews	Excellent for senior management	Time consuming. Needs skilled interviewer. Note-taking burdensome	Yes	Essential for detail
Plan and analysis	Excellent data source	Information overload	Yes	
Supplied Data	Can be a cheap source of data	Can be in poor form or imprecise or hard to interpret without help	Yes	Good for energy data
Monitored Data	Accurate. Quantitative	Cost. Sampling methods	Unknown	
Surveys	Comprehensive coverage. Quantitative and Qualitative	Tend to miss out fine points and context	Yes	Essential for base data. Also extremely useful to involve as many people as possible

Table 2.4: Comparison of POE Methods (Brooks and Vicar, 2006)

The Brooks and Viccar 2006 study also presented various questionnaire types and their use in POEs as shown in table 2.4. The second and the third column show the number of questions and number of pages of the questionnaire respectively.

SECTION HEADINGS	No. of Qs.	Pg. Nos.	RESPONSE CATEGORIES	CRITIQUE
<u>NHS TOOLKIT:</u> 1. Use 2. Access 3. Space 4. Character and innovation 5. Citizen satisfaction 6. Internal environment 7. Urban and social integration 8. Performance 9. Engineering 10. Construction	65	12	1:Very poor/ disagree/ to 6: Excellent/ agree	Specific to NHS buildings. Many sections are relevant to occupancy comfort. Lack of comparable questionnaires available without cost implications
<u>DESIGN QUALITY INDEX QUESTIONNAIRE:</u> 1. Use 2. Access 3. Space 4. Performance 5. Engineering 6. Construction 7. Character and innovation 8. Form and materials 9. Internal environment 10. Urban and social integration	97	10	‘Strongly disagree’ to ‘strongly agree’ with six possible responses and two additional response of ‘do not know’ and ‘not applicable’	No midpoint answer available. Many questions are not relevant to this study (e.g. construction process). Too onerous for the respondent- low rate of return predicted

Table 2.5: Comparison of POE Questionnaires (Brooks and Vicar, 2006)

Table 2.5 continued: Comparison of POE Questionnaires (Brooks and Vicar, 2006)

<u>BUS QUESTIONNAIRE:</u> 1. Background 2. Building overall 3. Personal control 4. Quickness of response 5. Response to problems 6. Comfort 7. Noise 8. Lighting 9. Overall comfort 10. Productivity 11. Health 12. Personal work space 13. Travel to work	66	2	7 tier answer scheme, each with its own parameters, which is based upon the Bedford scale (e.g. for temperature: 1-uncomfortable to 7-comfortable)	May come across as ambiguous, as tiers are not described. Interpretation could be 2 or 3 as slightly uncomfortable, or respondents could interpret the midpoint no. 4 as slightly uncomfortable. Rating answer scheme allows for a richer response than a simple yes/no scheme
--	----	---	--	--

The AUDE 2006 study compared various POE instruments and their application and usefulness as shown below. Methods adapted from this study into the current thesis study are indicated in bold in the table 2.6 below:

FORMAT & TECHNIQUES	FOCUS	TIME	POINT OF APPLICATION
<u>DE MONTFORT METHOD</u> 1. Forum 2. Building walk-through	Process review; Functional performance	1 day	1 year after occupation
<u>DQI METHOD</u> (Design quality indicators) 1. Questionnaires	Functionality; Building quality and impact	20-30 minutes for web-based questionnaires	Design stage after completion
<u>OVERALL LIKING SCORE METHOD</u> (7 point scale) 1. Paper-based surveys 2. Web-based surveys	Diagnostic evaluation	10 minutes for each occupant	12 months after occupation

Table 2.6: Comparison of POE Methods (AUDE and HEDQF, 2006)

Table 2.6 continued: Comparison of POE Methods
(AUDE and HEDQF, 2006)

FORMAT & TECHNIQUES	FOCUS	TIME	POINT OF APPLICATION
<u>PROBE</u> 1. Questionnaires 2. Focus groups 3. Visual surveys 4. Environment performance systems 5. Energy assessment	User satisfaction/ occupant survey; Productivity; Systems performance; Development of benchmark	Overall process time varies from 2 days to about 2 months	12 months
<u>BUS OCCUPANT SURVEY</u> 1. Building walk-through 2. Questionnaire backed up by focus groups	Occupant satisfaction; Productivity	10-15 minutes for 1 questionnaire	After 12 months
<u>ENERGY ASSESSMENT & REPORTING</u> 1. Energy use survey 2. Data collection from energy bills	Energy use and savings assessment	Full assessment up to 1 person week	Once building is completed
<u>LESSONS LEARNT</u> 1. Facilitated group 2. Discussions or interviews	Learn from experience of project team	Single seminar to continuous evaluation	Can be used before, during and after project as foresight, insight and hindsight reviews

Generally, the instrument used in a POE may be more or less effective based on the focus and aspects of the review being conducted by universities (AUDE and HEDQF, 2006). The different review types identified by the AUDE & HEDQF 2006 study are summarized below in Table 2.7:

	Operational Review	Project Review	Strategic Review
Timing of application	3-6 months	9-18 months	3-5 years
Main focus	<ul style="list-style-type: none"> • Process of delivering the project from inception to occupation of the building 	<ul style="list-style-type: none"> • Performance evaluation for specific areas/ functions • Functional and technical performance evaluation • Identification of adjustments/ corrections needed to School of Planning Design and Construction and its systems • Determination of cost in use 	<ul style="list-style-type: none"> • An organizational change and building response
Use of information	Process review- feed into future projects Building review- prepare to make changes in existing plan	To make adjustments to existing buildings and feed into future project planning and operations	To feed into future project planning and operations
POE level	Indicative	Investigative/ diagnostic	Investigative

Table 2.7: Types of Reviews (AUDE and HEDQF, 2006)

The current thesis study focused on project review to assess functional and indoor environment performance of renovated work-spaces in university settings such that the information obtained is useful to plan similar renovations in a more efficient manner and occupants are more satisfied.

The Brooks and Viccar 2006 study and the AUDE and HEDQF 2006 study indicated that occupant surveys were extremely useful to capture occupant perception in terms of building performance, their productivity and satisfaction. Therefore, for this thesis interviews were conducted to obtain insight from university owners,

administrators, managers and designers; following which, survey questionnaires were developed to assess occupant satisfaction for offices in university settings with regard to functional and indoor environment performance.

2.6. Significant POE Studies using Survey Questionnaires

Among several reviews, the following were identified to be of great significance to this study:

1. Berkley's Center for the Built Environment research on indoor environment quality (http://www.cbe.berkeley.edu/research/research_ieq.htm, 2008)
2. AUDE and HEDQF (Association of University Directors of Estates and Higher Education Design Quality Forum, 2006): A Guide for Post Occupancy Evaluation. (<http://www.aude.ac.uk/home>, 2008).
3. CABE (Commission for Architecture and the Built Environment, 2005). Design with Distinction: The Value of Good Building Design in Higher Education. (www.cabe.org.uk, 2009)
4. The Center for Sustainable Building Research in the College of Architecture and Landscape Architecture at University of Minnesota: Post Occupancy Evaluation of Carver County Public Works Facility for the Solid Waste Management Coordinating Board (2004).
5. Levermore G. J. and Leventis M. (1997): Occupant feedback using a questionnaire rating the liking and importance of up to 24 factors, Clima 2000 Conference.

These studies were useful in identification and comparison of commonalities and differences of POE factors, methods, and questionnaires. The content, structure, format, and composition of these questionnaires and the information were salient in the development of the trial POE survey for the current thesis study. Copies of these instruments are attached in Appendix D.




Center for the Built Environment, 2008

In 1997 a group of industry and government leaders teamed up with faculty and researchers at the University of California, Berkeley to address these challenges. This effort led to the creation of the Center for the Built Environment (CBE), a collaborative research organization serving a consortium of firms and organizations committed to improving the performance of commercial buildings. The Center for the Built Environment (CBE) operates under the National Science Foundation (NSF) Industry/University Cooperative Research Center (I/UCRC) program. CBE's mission is to improve the design, operation, and environmental quality of buildings by providing timely, unbiased information on building technologies and design techniques.




The visual format and design of the trial POE questionnaire used in the current thesis study is similar to that used in the CBE study since it has already been widely accepted and used. A snapshot of the survey is presented in Figure 2.9.

Office Layout

How satisfied are you with the amount of space available for individual work and storage?

Very Satisfied    Very Dissatisfied

How satisfied are you with the level of visual privacy?

Very Satisfied    Very Dissatisfied

How satisfied are you with ease of interaction with co-workers?




Very Satisfied    Very Dissatisfied

Figure 2.9: Snapshot of CBE Web-based Survey, 2009

(http://www.cbesurvey.org/CBESurvey/Instrument1003/officelayout.asp?locale=en_US&LID=1&PN=officelayout.asp&SID=1003&IID=1003&PID=4&NP=20&UID=570129&PL=x11110001101010101011&Status=1&pmode=undefined&yScale=undefined)

Guide to Post Occupancy Evaluation, HEFCE and AUDE, 2006

Findings from the HEFCE and AUDE, 2006 study have been referred to throughout this thesis and especially in chapters 2 and 3. A snapshot of the survey is presented in Figure 2.10 below. A full version of the survey is included in the appendix.

3. Time in building
a. How long do you spend in the building during the day?
(Please tick)

Hours	>1	1-2	3-4	5-6	7-8	>8
-------	----	-----	-----	-----	-----	----

4. Hours at VDU
a. How long do you spend working at a computer (average hours per day)
(Please tick)

Hours	>1	1-2	3-4	5-6	7-8	>8
-------	----	-----	-----	-----	-----	----

Location in building

5. Location
In an average week how much time do you spend in the following types of space? (if you are a student assume during term time)

a: Office (Please tick)

Hours	0-5	6-10	11-15	16-20	21-25	26-30	31-35	>35
-------	-----	------	-------	-------	-------	-------	-------	-----

b: Lecture room (Please tick)

Hours	0-5	6-10	11-15	16-20	21-25	26-30	31-35	>35
-------	-----	------	-------	-------	-------	-------	-------	-----

c: Laboratory (Please tick)

Figure 2.10: Snapshot of Occupant Survey in Guide to POE, HEFCE and AUDE, 2006

CABE 2005 study

The overall aim of the CABE 2005 study was to assess whether links exist between new, well-designed buildings and the recruitment and retention of students, staff and quality of teaching, research and other outcomes. In addressing the aim of the study, a number of key research questions were posed, namely: What features of buildings influence recruitment, morale and retention and performance of staff and students? Are staff and students satisfied with the quality and functionality of their buildings and associated facilities, and do they equate good quality with better performance? In this study, 51% of the features identified as being influential in recruiting staff could be classified as cosmetic and environmental. This included cleanliness, a feeling of space,

having a well-lit foyer and reception area, a minimalist appearance, or light and bright working areas.

In addition, 40 per cent of the features identified by staff as potentially influencing their choice of university could be classified as structural or functional. These included lecturing and teaching rooms, automatic doors, computer terraces, internal layout and design, whether or not the building was aesthetically pleasing, and the overall shape and structure of the building.

The remaining nine per cent of the features identified by staff were classified as situational. These related to the proximity of the building to the city centre, and the proximity to other major university buildings, as well as accessibility to main transport routes and links. Additional comments from staff also illustrated the importance of specific building features when people choose a place of employment. In addition, some staff identified features that might have a negative influence on their choice of employment. These included a bad use of space, noisy buildings, and buildings that look unattractive.

CSBR 2004 study

The Center for Sustainable Building Research, College of Architecture and Landscape Architecture, University of Minnesota in December 2004 conducted a POE of Carver County Public Works Facility and prepared a report for the Solid Waste Management Coordinating Board. A snapshot of the CSBR survey is presented in Figure 2.11 below. A full version of the survey is included in the appendix.

SWMCB Post Occupancy Evaluation: Carver County Public Works Facility																			
<h2>Appendix D: Occupant Survey Form</h2> <p style="text-align: center;">Solid Waste Management Coordinating Board Post Occupancy Evaluation</p> <p>(1) What is your primary workspace?_____</p> <p>For the following questions please circle a number from 1-7 that best reflects your response to the question.</p> <p>(2) How healthy do you feel after completing your work in the building each day?</p> <table style="width: 100%; text-align: center;"> <tr> <td>Very unhealthy</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>Very healthy</td> </tr> </table> <p>(3) How healthy do you feel when you are not in the building?</p> <table style="width: 100%; text-align: center;"> <tr> <td>Very unhealthy</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>Very healthy</td> </tr> </table>		Very unhealthy	1	2	3	4	5	6	7	Very healthy	Very unhealthy	1	2	3	4	5	6	7	Very healthy
Very unhealthy	1	2	3	4	5	6	7	Very healthy											
Very unhealthy	1	2	3	4	5	6	7	Very healthy											

Figure 2.11: Snapshot of Occupant Survey Form, SWMCB POE: Carver County Public Works Department (Source: CSBR 2004)

Levermore and Leventis, 1997

A study by Levermore and Leventis conducted in 1997 was reviewed to acquire more information and support rationale for the chosen POE factors. The factors identified by Levermore and Leventis were: “noise level, electric lighting, daylight, glare level in the room, office temperature, ventilation, draught level, freshness of your room, humidity, smell in the building, colors of the room, attractiveness of the room, control you have over your local environment, your privacy in the room, outward appearance of your building, your distance away from the window”.

Menzies and Wherrett, 2004

Menzies and Wherrett conducted post occupancy evaluations of four buildings in 2004 using survey questionnaires administered to building occupants. Their study

focused on windows in buildings and contended that “windows are responsible for a disproportionate amount of unwanted heat gain and heat loss between buildings and environment”. The questionnaire had three sections and included (1) personal information, such as age and gender; (2) room information including the proximity of the nearest window to the occupant; and (3) occupant satisfaction with regard to thermal comfort, acoustic comfort, window controllability, and lighting. As indicated in the study conducted by Menzies and Wherrett in 2004, location and access to a personal window had an impact on building occupant satisfaction. Therefore a question about window location and access was included in the POE survey developed for this thesis study and a similar structure of sections and sub-sections was patterned after those used by Menzies and Wherrett study.

2.7. Chapter Summary

This chapter presented the summary of the literature reviewed for this study, which was divided in three sections as shown earlier in Figure 2.1. The first section, ‘Section 2.2: Post Occupancy Evaluation’ discussed the fundamentals of POE. The second section 2.3- ‘post occupancy evaluation factors’ presented the different functional and indoor environment evaluation factors found in literature and its relation to workplace productivity and occupant satisfaction, which helped to identify the evaluation factors for this study. The third section 2.4- ‘post occupancy evaluation: application’ presented significant POE studies found in literature that include post occupancy evaluation. This was used to identify the evaluation aspects and questions and to identify

the successes and failures of each methodology and derive insight that minimized obstacles and challenges, which may have been experienced in this study otherwise.

CHAPTER 3

METHODOLOGY

3.1. Chapter Overview

This chapter presents a discussion of the research methodology, which consists of four phases and sixteen detailed steps. First, the four phases of the study are explained generally, and then each phase and step is described in detail. Figure 3.1 presents an overview of the research methodology. Figures 3.2, 3.3, 3.4, and 3.5 present the various detailed steps to be followed in each phase to achieve the research goal and objectives.

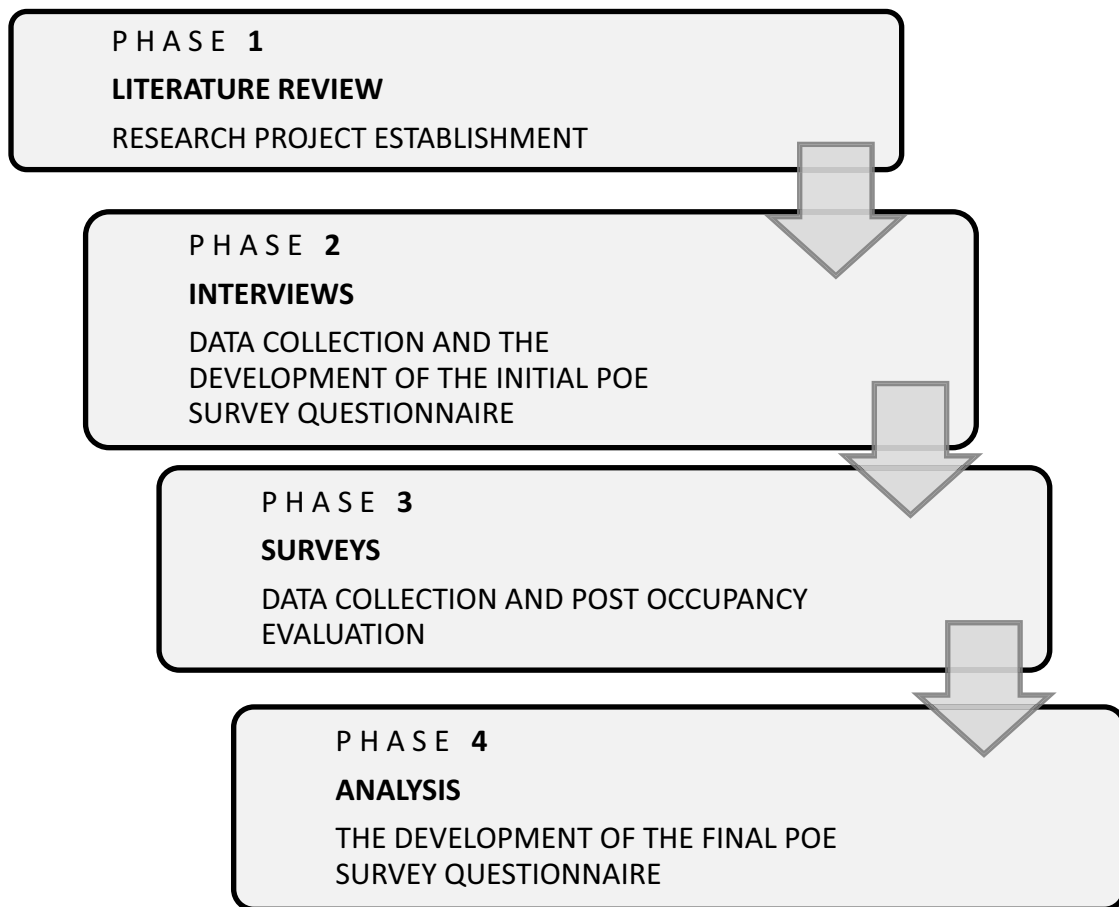


Figure 3.1: Overview of the Research Methodology

This chapter is divided into seven sections that present the chapter overview, the methodology overview, the four phases of this study, and the chapter summary. Each section is further divided into sub-sections that discuss the detailed steps and focal aspects of each phase in the study.

3.2. Overall Methodology

As shown in Figure 3.2, during the first phase, literature review was conducted to determine the significance for a study such as this. Then, the research project was defined in terms of its goal and objectives, scope and limitations, and deliverables. Next, existing literature was reviewed thoroughly with regard to post occupancy evaluation studies in order to identify functional and indoor environmental aspects that impact occupant satisfaction in university office environments, and to review existing evaluation (data collection) methods. The details of the literature review are discussed in Chapter 2. It was found from the comparison of similar studies that POE surveys were appropriate in determining building-user perception and satisfaction with regard to their personal work space performance.

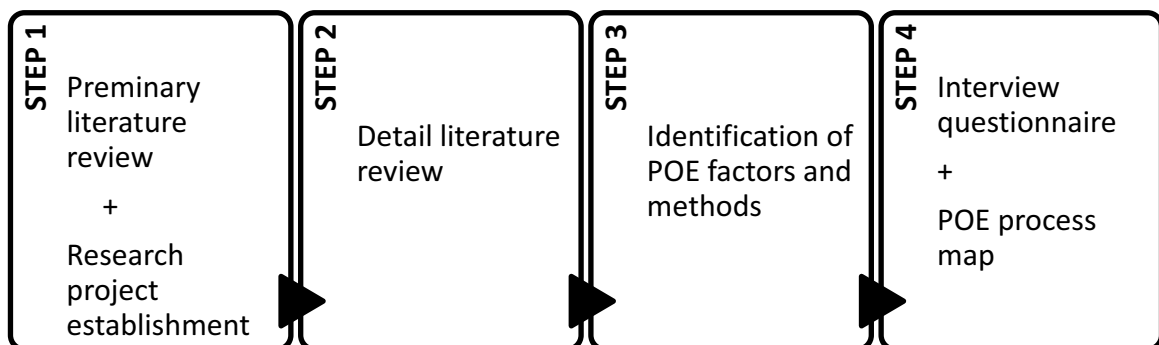


Figure 3.2: Phase 1 Overview

However, the literature was not sufficient enough in determining the university environment specific evaluation factors, such as preferences and requirements of users (staff and faculty). The information from the literature review was extremely helpful in accumulating a set of evaluation factors and methods which further led to the development of an interview questionnaire.

Once the interview questionnaire was complete and approved by the university, Michigan State University owners, administrators, managers, and designers were contacted. This was the onset of Phase two. Among 25 individuals contacted, eight agreed to participate and were interviewed. The interviews were exploratory and the purpose of them was to gain insight from experienced university administrators, owners, designers, and managers who are regularly involved with design, construction, and the operation of facilities. The interview responses were recorded and analyzed qualitatively. Figure 3.3 presents an overview of Phase two.

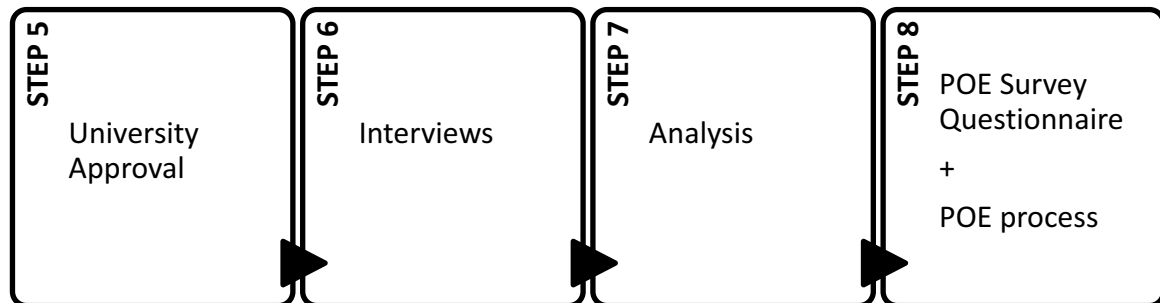


Figure 3.3: Phase 2 Overview

The interviews were a way to capture the perceptions of university providers about POE. The idea was to later map/speculate/investigate the acquired occupant/university user perceptions of POE for consistency with that of the providers.

The interview findings were fundamental to the development of the POE survey and the POE process. The initial POE survey and the process are presented in section 3.5.

This led to Phase three, which is most significant in this study. As shown in Figure 3.4, once the POE survey questionnaire was ready, it was reviewed for fine-tuning by a group of university personnel recommended by the Michigan State University Assistant Vice President of Finance and Operations. This group consisted of university facility owners, administrators, managers, designers, and occupants, who belonged to various offices that design, build, and maintain buildings on campus. A second review was conducted with a smaller group of university administrators. Following this, modifications were made to the POE survey questionnaire, and it was ready for evaluation.

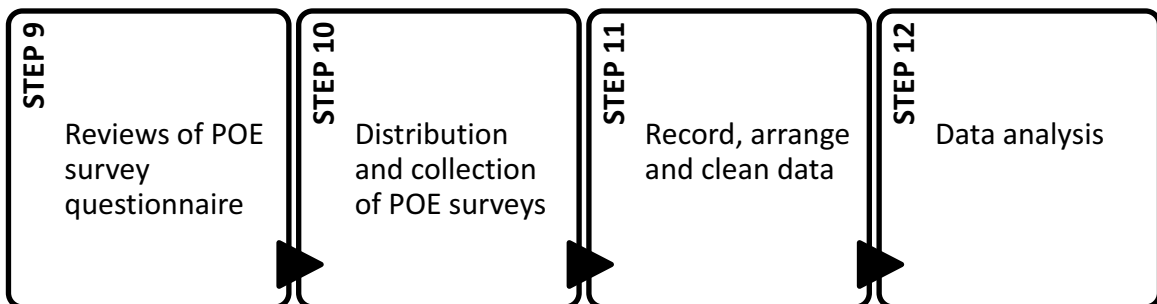


Figure 3.4: Phase 3 Overview

In the meantime, two university renovated projects were selected as case studies to test the trial POE survey: the School of Planning Design and Construction and the Spartan Way. The trial survey was delivered to both building occupants in three days. Building occupants were requested to return the completed survey within seven days. Survey responses were then recorded and analyzed. The method of data collection and analysis is described later in section 3.5. The data and analysis are discussed in Chapter Four.

As shown in Figure 3.5, the final POE survey questionnaire was developed during the last phase. The findings from the data analysis were divided into two categories: building specific and survey specific. Building specific findings were a result of analysis of responses to sections one, two, and three in the survey and survey specific findings were a result of analysis of responses to section four in the survey.

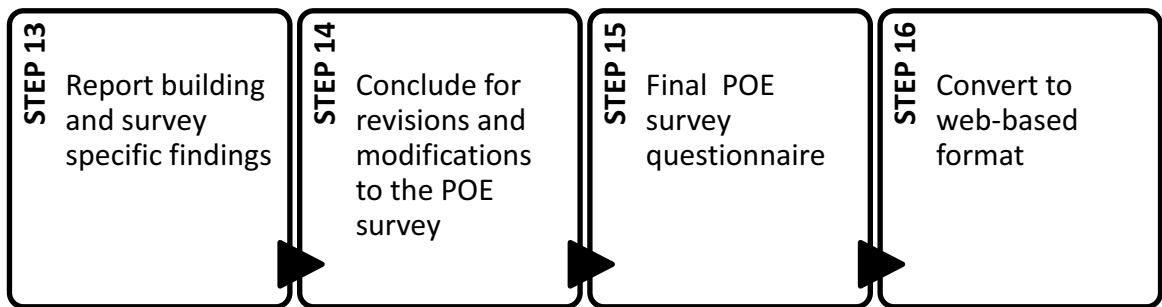


Figure 3.5: Phase 4 Overview

Researcher's Learning:

The researcher learned from the responses to the survey feedback section that a web-based survey format was preferred over a paper-based format as used in this current study to gather responses, especially if a large population was under consideration. A paper-based format, although preferred by many office users who work mostly on computers, was only beneficial when a smaller sample was being evaluated for satisfaction. The survey feedback responses also indicated that the use of a web-based format could also reduce the efforts of the evaluators which could instead be well-spent making an analysis and recommendations towards corrective actions. This would also facilitate the creation of a database and its integration with a larger database system that would store and use data from all buildings on campus and would be useful in tracking

previous problems encountered, corrective actions taken, their supporting rationale, and final effects.

3.3. Research Project Establishment

The first phase consisted of four steps as shown earlier in Figure 3.2. The deliverables from this phase were the interview questionnaire and the POE process. Once the research project was defined, literature was reviewed in detail to develop an idea of the-state-of-the-art information about existing POE factors and methods.

3.4. Literature Review: Identification of Evaluation Factors and POE Methods

Literature written between the 1980s and 2008 was reviewed to identify the factors that impact functional and indoor environmental performance and to locate significant POE factors and methods that exist. Several studies were reviewed for this purpose. Five significant studies were found, whose findings are summarized in Chapter two- literature review. The POE instruments found in the literature were reviewed and compared to establish a set of interview questions. Additional questions were formulated from interviews, with input from the rest of the research team and selective university administrators (who were involved in the research project establishment phase). Interviews were conducted in order to investigate consistency with the findings of the literature in a present day context for large universities and are discussed in the following section.

3.5. Interviews

The purpose of the interviews was to obtain exploratory information and the valuable insight of experienced professionals about aspects that they consider salient for building performance evaluation, as well as aspects that provide measures of building occupant satisfaction level for renovation projects in universities. The interviews also helped to obtain insight from university personnel about the kind of POE instruments that are preferred and the answers to other research questions such as: how useful POE is from the perception of university owners, administrators, managers, and designers; what cost should be associated with POE; and how reliable building occupants are as a source of data for POE.

The interview questionnaire was divided into three sections: evaluation processes, evaluation aspects, and POE. The first section, “**evaluation processes**”, explored if the focal university had established post-construction or post-occupancy evaluation processes for buildings. Why aren’t there processes? What are the barriers? But if there are processes established by the organization, then, is it a standardized process? How is the information used, and what resources are required? The second section, “**evaluation aspects**”, sought the opinion of interviewees with regard to functional, technical, and indoor environmental aspects that must be included in the assessment of user satisfaction and building performance. The third section is specifically on “**post occupancy evaluation**”, which sought the insight and opinion of facility owners, managers, and designers with regard to the value of POE, its uniqueness of role in facility performance measurement, POE instruments, and costs. The interview questionnaire is discussed in detail along with the responses in Chapter Four (Section 4.2).

The interview questionnaire was subjected to the Michigan State University Institutional Review Board to obtain permission to interview university personnel. On receiving approval, approximately 25 university professionals involved directly with the facility design, operations, and construction project delivery at Michigan State University were contacted, and those willing to participate were interviewed. Each of these interviews took about 30-45 minutes. Personnel who did not respond were contacted again, and after a third attempt, interviews were closed for analysis.

The interview responses were first typed verbatim for qualitative analysis of perception and then responses were coded to facilitate quantitative analysis to determine preferred evaluation factors. Evaluation factors determined from the analysis were included in the POE survey along with those from the literature review. The interview analysis is discussed in detail in Chapter four: data collection and analysis (Section 4.3). The interviews were also helpful in determining the interviewees' views on the reliability of building occupants' perceptions towards building performance evaluation. The interview responses were analyzed to obtain information about who should conduct a POE, analyze, report findings, arrange for corrective measures, determine the acceptable costs, and decide the formats and resources that are most effective in reporting the results. The interview findings represented the perceptions of the university personnel and their expectations from POE.

Selection of Interview Participants

Based on the research project scope and literature review, it was concluded that interviews of university personnel would be helpful in obtaining their insight and

understanding their perceptions, needs, and expectations with regard to POE. Therefore, the Michigan State University Office of Vice President for Finance and Operations was contacted for approval to interview university personnel who are closely involved with day-to-day design, maintenance, and operation of facilities.

Confidentiality of Interviewees

The identities of interview participants have been, and will be, kept confidential. The personnel contacted for interviews were informed about the project using a participant consent form, a copy of which is attached in Appendix A of this document.

3.6. The Development of the Initial POE Survey Questionnaire

The POE questionnaire included questions that resulted from the literature review and the interview analysis. First, various POE studies were compared to determine a comprehensive list of factors and then to determine a comprehensive list of questions related to those factors. The findings of previous studies are discussed in Chapter Two. Second, the interview responses were reviewed for insights about the development of the POE survey. The interview analysis is presented in Chapter Four. This resulted in a total list of evaluation factors and questions that were sorted in categories: functional performance and Indoor environmental performance. Each category further contains numerous sets of questions, and each set includes about two to three questions that addressed a particular evaluation factor.

3.7. POE Survey Review and University Approval

The interview responses and literature review findings indicated that a survey would be the most appropriate option to assess occupant satisfaction. The evaluation factors determined from literature review and interview analysis were incorporated in the POE survey questionnaire. This phase was critical and salient in giving direction to the remaining phases of this thesis study.

The first draft of the POE survey was prepared and mailed to Michigan State University administrators for review. The survey was then modified and sent to the Vice President's office to request final approval for distribution. The survey was then also submitted to the University Institutional Review Board for approval. This review is required in order to ensure research participants' protection. After approval of the research, facility administrators were requested to provide contact information of building occupants who occupied office spaces. The surveys were then delivered to occupants in two buildings on Michigan State University campus; including, the School of Planning Design and Construction and Spartan Way.

3.8. Distribution and Collection of POE Surveys

The survey was distributed to 50 occupants in the School of Planning Design and Construction (SPDC) and 120 occupants in Spartan Way (SW). The respondents were informed about project details and the protection of their rights by a participant consent form attached to the distributed surveys. Respondents were requested to return completed surveys within seven days in a collection box that was placed in their mailrooms. Non-respondents were sent reminders and were requested to respond in additional seven days;

following which, the survey collection was closed for analysis. The survey distribution was first conducted in the SPDC, where it was hand-delivered to the occupants. Though this method of distribution was very effective, it was very time consuming and not an efficient process. This experience was accepted as a “lesson learned” from the project. For next distribution for SW, the surveys were delivered to the respective mail boxes of occupants. The surveys were collected back in the same way from both facilities. The surveys were coded by random unique numbers which were assigned to each occupant in order to track responses and track data.

3.9. Description of the Pre-final POE Survey

The survey was comprised of four sections. The first section focused on the functional aspects of a building, the second section focused on the indoor environmental aspects of a building, the third section focused on the general information of building occupants, and the last section focused on the feedback about the overall survey. For reference, a copy of the survey is attached in Appendix B. The primary objective of the initial POE survey in this study was to receive feedback with regard to the survey itself; the secondary objective was to assess occupant satisfaction in these two buildings. Therefore, a survey feedback section to receive feedback was presented after the satisfaction assessment sections. Although the arrangement of the sections may continue to be the same in the final survey, the primary objective of the final POE survey would be to assess satisfaction and to gather survey feedback. A detailed discussion of the trial questionnaire is presented in the subsections 3.9.1 to 3.9.4.

3.9.1 Functional Performance

The Functional Performance section has a total of 38 questions, which relate to sixteen functional aspects that directly or indirectly impact the satisfaction of occupants.

Questions 1-11 and 17-29 are related to the physical and visible aspects of space. These aspects are as follows: office layout, location of workspace, amount of space for work and storage, office furniture, office furnishing, office equipment, accessibility to personal workspace from entrance, ability of personal control, and the window location and view. Evidence was found in the literature and from the analysis of interviews in this study that these factors greatly impact occupant satisfaction (Kooymans and Haylock 2008; Horgen et al. 1997; Gonzalez et al. 1997). The satisfaction rating of items on a seven point-likert scale was further expanded using open-ended questions that inquired about changes occupants would recommend if they were dissatisfied.

Questions 12-16 were related to the aspects that impact occupants' psychological satisfaction with the functionality of building design. Questions 12 and 13 inquired how easy it was for staff and faculty to interact with their co-workers, where Question 13 was open-ended and inquired about changes occupants would recommend if they were dissatisfied. It was found in the literature that occasional interaction with co-workers facilitates essential communication also provides a break from the tedious and routine work hours (CABE 2005). It was concluded from the surveys that average staff-work-hours varied from 35-40 hours per week and faculty-work-hours varied from 15-60 hours per week.

Questions 14-16 investigated how satisfied occupants were with their privacy (overall and visual). Question 16, which was open-ended, enquired about the changes that occupants would recommend if they were dissatisfied with their privacy.

The two major types of questions that were used in the survey are demonstrated in Figures 3.6 and 3.7, which focus on satisfaction and yes/no questions.

Section 1: Occupant Satisfaction with regard to Functional Performance

Please note: Functional performance refers to the performance of the design components of your workspace towards your task performance.

On a scale of 1 to 7, where 1=very satisfied, 2=satisfied, 3=slightly satisfied, 4=neutral, 5=slightly dissatisfied, 6=dissatisfied and 7=very dissatisfied, please indicate your level of satisfaction with regard to the following aspects:

1. How satisfied are you with your office layout i.e. the placement of your workspace/ cubicle/ rooms with regard to your surrounding workspaces/ cubicles/ rooms?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

Figure 3.6: Structure of ‘Satisfaction’ and ‘Open-ended’ Questions

5. Does your personal work space function well for your job responsibilities?

○ Yes

○ No

○ Not applicable

6. If your answer is No, please explain why?

Figure 3.7: Structure of “Yes-No” Questions

3.9.2 Indoor Environmental Performance

The indoor environment section had 22 questions. Most questions in this section were “satisfaction questions” based on indoor environmental aspects that directly or indirectly impacted satisfaction and work performance of building occupants.

Questions 39-60 assesses how satisfied or dissatisfied occupants felt with regard to the lighting, thermal comfort, air quality, and acoustic comfort of their personal workspace.

Questions 39-43 were grouped under the “lighting” category and focused on: natural lighting, artificial lighting, visual comfort, and overall comfort. Question 43 was a question that needed an open-ended response from occupants with regard to what they would change about the lighting of their personal workspace if they were dissatisfied.

Questions 44-48 were grouped under the “thermal comfort” category and focused on: temperature, humidity, ventilation, and overall thermal comfort. Question 48 is an open-ended question which asked occupants what they would change about the thermal comfort of their personal workspace if they were dissatisfied.

Questions 49-51 were grouped under the “air quality” category. Question 51 was a question that needed an open-ended response from occupants with regard to the changes they would recommend to enhance the air quality of their personal workspace if they were dissatisfied.

Questions 52-54 were grouped under the “acoustic” category. Question 54 was a question that required an open-ended response from occupants with regard to their level of satisfaction with the acoustic quality of their personal workspace.

Questions 55 and 56 inquired if occupants considered that the overall indoor environment of their workspace would have an impact on their work performance and productivity and, if they agreed, what was the extent of the impact?

Questions 57-60 asked if any new technology had been implemented in the personal workspace of building occupants, and if yes, how satisfied they were with it.

3.9.3 Participant information

This section had nine questions, which gathered information about respondents and included the following: demography, length of time that they have been working in their current personal workspace, number of hours that they would work per week, and a description of their workspace and activities. The purpose of this section was to understand the population characteristics of the people who occupy university office spaces, the kinds of activities they performed, and the evaluation factors that impacted their satisfaction.

3.9.4 Survey Feedback

This section in the survey had eleven questions that solicited user input about the survey. Question one asked for the amount of time taken by a respondent to complete the survey. The purpose of this question was to determine the average and maximum time taken by respondents to complete the survey, and to see if it was necessary to modify the survey such that the time for survey completion was minimized while the depth of satisfaction assessment was maximized.

Question two to five directly inquired about the format and structure of the survey. For example, questioned if the respondents were satisfied with the survey format, appropriateness of questions, the balance of closed versus open-ended questions and, the method of interaction preferred in future. Questions six inquired about occupants' preference between participation in focus groups of adjacent workspace occupants and surveys. Question seven asked, "To what extent did the survey cover aspects that the respondent would like to comment upon about their office?" Questions eight to eleven gathered occupants' opinion with regard to the additional factors and questions that must be included in the POE survey to achieve its primary objective.

3.10. Data Recording and Arrangement

The survey responses were recorded verbatim in Excel spreadsheets and then analyzed based on the range and pattern of responses. The data collected with the help of the POE survey was recorded and organized in Excel spreadsheets in numeric code and in an open-ended format to facilitate a quantitative and qualitative analysis of data.

3.11. Data Analysis

The surveys received from the SPDC and SW were first analyzed separately to understand how each building performs for its users; and then the responses were summarized to develop conclusions with regard to the evaluation factors and to help develop additional questions from the survey open-ended responses. The survey findings from both of the buildings were presented in two categories: building performance and survey feedback.

The building performance results were directly related to the POE of the building itself and the survey feedback was related to the occupant responses specific to the survey itself. The survey feedback results were the focus of the analysis in this thesis study. Next, the building performance results and the survey feedback results were combined to develop overall conclusions with regard to individual buildings. The findings from individual buildings were then merged again to develop final conclusions with regard to the survey modifications based on the commonalities, differences, and speculations of this study. The overall conclusions for the survey were useful in making changes to the trial POE survey to develop the final version. The overall data analysis is discussed in detail in Chapters Four and Five.

3.12. Chapter Summary

Chapter 3 presented a detailed discussion of the methodology followed to accomplish the research goal and objectives, and how the data collection tools were developed, how the data was collected and analyzed. Chapter Four, Data Collection and Analysis, discusses the data collection tools developed in this study, the data collected and analyzed, and the findings.

CHAPTER 4

DATA COLLECTION AND ANALYSIS

4.1 Chapter Overview

This chapter presents a detailed discussion of the data collected and analyzed during this study which includes interviews, surveys, analysis, and conclusions. First, the interview and related analysis are presented. Next, the post occupancy evaluation is explained separately for both buildings: the S.P.D.C. and the Spartan Way. Then, the survey specific findings from both buildings are presented together to determine the commonalities, differences, and uniqueness of responses. Following this, the overall analysis and conclusions are presented.

4.2 Interviews

As mentioned in Chapter 3: Methodology, the purpose of the interviews was to obtain exploratory information and valuable insights from experienced university professionals with regard to a POE. Though it was not a conscious attempt, it was later realized that interviewing the university providers and surveying the university users made the study more holistic, since the researcher was able to acquire perceptions from both administrators and users. The questionnaire had three sections consisting of 26 questions. The purpose of each section in the questionnaire was explained earlier Chapter 3 (Section 3.5). The interviewer gathered responses with regard to the presence or absence of a POE process within the university. If such a process was absent, what were barriers? What measures could be taken to ensure sufficiency of resources? What

evaluation factors should be considered? What kind of questions should be asked of the building occupants? When should a POE be conducted and how often? How useful and accurate were occupants as a source of information about building performance? What could be the benefits from a POE? What should be the basis for POEs? What POE measures could be effective in evaluating building performance? What percentage of the overall project budget should be reserved for a POE? The response to the above mentioned questions are discussed in the following section.

4.2.1 Analysis of Interview Responses

The interview responses were recorded verbatim in adjacent columns in Microsoft Excel spreadsheets as shown in the snapshot below in Figure 4.1 for comparative qualitative analysis.

Interview questions	Response 1	Response 2	Response 3	Response 4	Response 5
1 Do you currently conduct any of the following? Explain/Identify.	No		No		No
a Project post mortems/ project performance evaluation (description of items: contract, schedule, budget, procurement, safety, change orders, punchlists, etc)		We have started some development of scorecards for various project participants such as suppliers, architects, customers. We also have a questionnaire for contractors that evaluates E&S performance. Also, the CRA provides quarterly and annual reports for Fred Poston's office.		Evaluation of project participants are done with score cards; also, 'project de-briefing' is done by design and construction representatives. We do an informal session for 'lessons learnt' to highlight the good and bad experiences during a project. Many things are done but none of it is formally documented and that's a formal process is required.	
b Post occupancy evaluation (POE) (building performance evaluation after occupancy)		No formal process. During past year we did technical evaluation for 4 large projects: Computer center, duffy daughterly, public spaces in Holden hall and Engineering building lobby. Also, we do commissioning which satisfies the technical and IEQ but excludes the functional evaluation.		No but a building user's evaluation is required to obtain knowledge of the true experience and feelings of occupants.	
i Functional			We do not have a formalized process as we get calls whenever there is problem and it is resolved immediately. We do not see any value in conducting unless we know that the client/ users are dissatisfied.	There is no formal process. In the past, we have gleaned some knowledge but it is not documented systematically and thoughtfully.	
ii Technical					
iii Indoor environment					
2 If you conduct any of the above processes do you have a standardized approach? In this process written? If so may we obtain a copy of any instruments used or process descriptions?	NA	Refer copies of score cards provided	NA	Score cards	NA
3 If you do conduct such processes, how is the information used? Does information collected serve primarily as a facility management tool, diagnostic tool, to identify corrective measures for the specific project or is it used for information for improving future projects or processes.	NA	NA	NA	For Contractors- scorecards help keep track of contractor's performance. If a contractor is consistently performing below average, they are warned on the basis of prior data and not whimsical analysis. For owners- contractors evaluate and identify areas where owner is not performing well and may be impeding the progress of construction. It is envisioned that this will enhance the owner's performance.	NA
4 If your organization does not typically conduct POE, why not? What barriers do you experience or anticipate?	The organization does not or cannot conduct POE or post mortems due to absence of a leader who will bring together all the components and execute the process, and absence of the process itself. Due to lack of information with regard to what would be the evaluation components, who will conduct it and which all other disciplines should be involved in order to facilitate interaction and communication related to the project in one room. For example, how do we evaluate steam tunnels or roads on campus.	In universities, physical plant maintains space. In MSU, Athletics and Housing pay PP for maintenance for others, the cost is a barrier which must be embedded in the project costs. There is no funded source of revenue to pay for this kind of activity yet in MSU.	We do not do it because it is not a part of the process that we presently follow. Other than this there is not specific answer to this question	The worry on part of some potential improvement as failure. More trust is required amongst project participants to understand that the intention is not to criticize but to get jobs done more efficiently. The anxiety towards the process; building occupant's time, investment towards evaluator's time and that of planning team, because of the present workload.	Lack of resources well defined
5 If your organization does not typically conduct Project Post Mortems, why not? What barriers do you experience or anticipate?				Score cards are done to evaluate performance of project participants.	Lack of resources well defined

Figure 4.1: Snapshot of Interview Record Spreadsheet

The interview responses were analyzed as *free flowing text* using the methods: *key-word-in-context* and *word count* to identify patterns of ideas and opinions in the body of responses to open-ended questions (Denzin and Lincoln 2005). Additionally, several lists were extracted from the review of responses (for example: list of perceived POE benefits, and POE evaluation factors). A summary is provided of the interview findings in the order of the questions asked:

Presence of a formal process: Out of 25 individuals contacted, eight responded to the interview questionnaire. Six out of the eight personnel indicated the presence of an informal evaluation process but also an absence of a formal POE process (Question one). The remaining two participants did not address presence of either a formal or informal process.

Usefulness of a POE: The open-ended responses included: (a) “POE would be highly useful to universities”, (b) “POE would initiate a process of continuous learning towards changes required in buildings due to changing working relationships between people to better support work activities of future occupants”, (c) “POE is useful for future space planning and captures the information that may not surface physically (for example: emotional reactions)”, (d) “POE adds value to building performance so that current problems can be detected and future problems can be avoided”, (e) “POE promotes the feeling that the central university or university leaders care about their employees”. A comment from an interview respondent was, “We do not see any value in conducting it,

which is an added expense, unless we know that the users are dissatisfied” (Question thirteen).

Benefits of a POE: As stated in the open-ended responses: (a) “POE could lead to incremental changes in quality control, staff productivity and employee attitude, which affects employee outcomes”, (b) “POE can provide a feedback loop, which is presently missing and can help correct problems in buildings and create alerts for future projects”, (c) “POE can communicate to users that their organization cares for their satisfaction and well-being, which will develop good will amongst customers and may be beneficial for both users and owners” (Question 14).

The usefulness and accuracy of building occupants’ perceptions towards building performance evaluation: Six out of eight interview respondents consider occupants to be a highly accurate and useful source of information with regard to building performance evaluation. One of the respondents considered occupants to be an accurate and useful source of information in a group, but not as individuals. Another respondent considered occupants to be a great source of information with regard to only building areas that they regularly use (Question 11 and 12).

Time and frequency of application: It was concluded from the interviews that a POE should be ideally conducted between six to twelve months after occupancy. Three out of eight interviewees stated that POE can be conducted once every five years throughout the building life cycle. Others did not state any specific time frame. One of the respondents

stated that most problems are revealed within the first year and after that it depends on overall building use and maintenance.

Evaluation factors: The various functional and indoor environmental performance factors that came up from the interview responses are: the physical flow of people traffic and communication, layout of furniture, furnishings, office equipment and appliances, lighting, thermal comfort, acoustic, storage space, cleanliness, spatial orientation, adequacy of personal workspace, maintenance accessibility, proximity and adjacency of related function areas, accessibility, air quality, productivity measures, occupant satisfaction, etc. These factors along with those identified in the literature were later included in the POE survey (Tarricone 1999; Bottom et al. 1997; Gonzalez 1997; Kincaid 1997; Farrenkopf and Roth 1980; Proceedings of Healthy Buildings 2006; Zagreus et.al. 2004).

POE questions: Similarly, interviewees suggested the kind of questions that may be asked in the POE survey. Did the office function for users function as intended in terms of people traffic and communication? If given a chance, what would users redo about their office space? Is the project within the planned budget? What other options did users have that affects the costs? Is the perceived privacy satisfactory? Is the acoustic quality satisfactory and are the lighting levels supportive of their functions? Does the space perform as envisioned and support all of your functions? Does the space work for you as anticipated? Did the space meet the user's organizational goals and objectives? How do we do it better? Do users have positive feelings about their space? Is the office size and

layout working for users? Is the office furniture and furnishing ergonomically comfortable and functionally useful? Since MSU has a fixed percentage that is reserved for artwork, should it be inquired if it is truly appreciated or if it goes unnoticed, thereby justifying the investment made? Does the space have good quality? Overall, does the space perform as intended? Is any particular area too far or too close to user's space and interfere with their task performance? Do users consider themselves more efficient now? These questions were reworded to formulate more comprehensive questions in the POE survey with a focus on occupant satisfaction.

What should be the basis of a POE? How these are usually developed? The interviewees stated that in order to plan and conduct a POE, the following documents may be considered as a basis: construction standards, general planning requirements or design guidelines, design program, etc. In this study, the basis of the POE was the expectations of university personnel, which was determined from the interviews.

How much should POEs costs? With regard to this question there was no unanimous response from the interviewees. The different numbers stated were: *less than 0.1%, 0.1%, 0.25%, and less than 0.5% of project cost and 2% of project closeout costs*. Considering what was found during the literature review, the exact POE costs is not a straight number and it depends on many factors. These factors may be: building complexity in terms of design or systems involved the availability of resources to conduct POE such as time and money, the expected outcomes of POE, etc. The cost of the evaluation involved in this

study was covered by the research team which was a total of \$1000 including both facilities (this cost does not include the cost of the research team).

Who should plan and conduct POEs? Seven out of eight interviewees stated that internal staff should be responsible to plan and conduct POEs. It was contended that the internal staff is preferred because: “an outside consultant will be more expensive, he or she will develop certain amount of resident knowledge pertaining to MSU buildings and for information sharing”. This evaluation was planned and conducted to meet the objectives of this study by the researcher. Although university personnel provided feedback, however, the resources were primarily expended by the research team.

What POE methods/tools are considered useful? According to interviewees, walk-throughs, physical observation, structured interviews, building inspection, assessment of facility maintenance records, web-based surveys, progress photos, and focus groups are all efficient building evaluation tools. Considering that a POE involves occupant perceptions, structured interviews, web-based surveys, and focus groups remain as effective POE specific methods. Further considering the building type, occupant category, number of occupants, and expected outcome of evaluation; web-based surveys were concluded as inexpensive and effective POE tools that reveal significant issues in less time with less effort. All interviewees agreed that these tools, if used in combination, will be helpful because one method may be more effective in looking at a specific area or aspect than another, give a broader picture about the building's performance, or help gather perceptions of occupants and managers. The purpose of this question was to

inquire about the significance of a survey questionnaire and if developing it would be valuable to the university system.

Overall, it was determined from the interviews that large universities like MSU believe that there is a need for a POE process in their system to periodically assess the performance of buildings on campus and to determine occupant satisfaction. The interview data indicates that university personnel would prefer a formal process instead of an informal one. They considered the POE to be useful and beneficial and consider occupants to be a reliable source of information with regard to building performance. It was mostly indicated that the POE should ideally be conducted after six to nine months, and before one year from the day of occupancy. The interviewees suggested evaluation factors and related questions, which were incorporated into the trial POE survey. The following sections in this chapter will discuss the survey data, the analysis, the findings, and the conclusions from the POE of the two buildings: the S.P.D.C. and the Spartan Way. Figure 4.2 presents an overview of the structure and analysis for the initial POE survey.

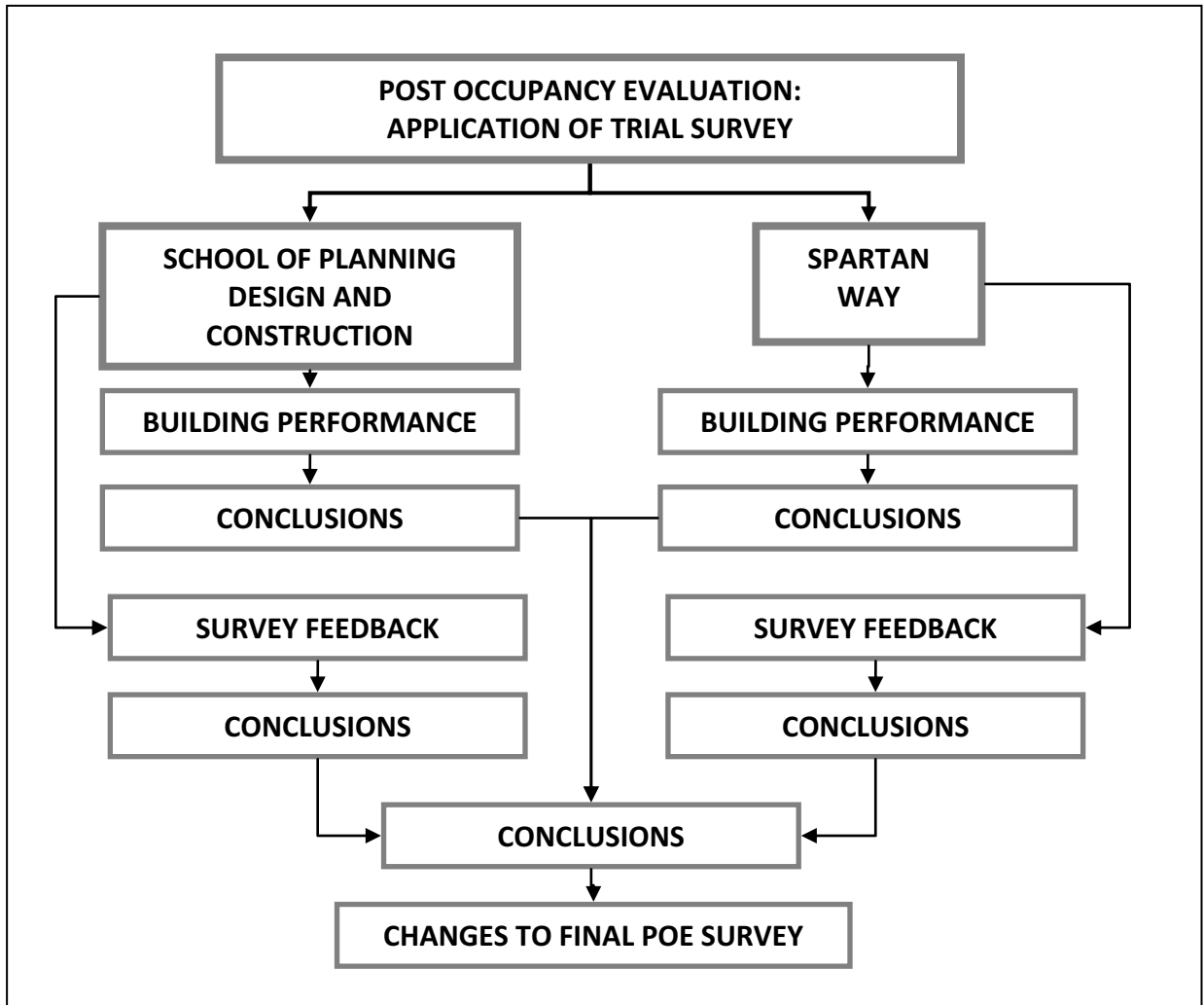


Figure 4.2: Structure of the Data Analysis

4.3 Post Occupancy Evaluation: Application of the Trial Survey

The trial POE survey was tested/used/applied in two buildings at MSU, and then modified based on survey feedback. A detailed discussion of the post occupancy evaluations at the School of Planning Design and Construction and Spartan Way is presented in sections 4.3.1 and 4.3.2 respectively.

4.3.1 CASE STUDY NO.1

THE SCHOOL OF PLANNING DESIGN AND CONSTRUCTION

This section and following sub sections present a discussion of the survey feedback and analysis from the School of Planning Design and Construction (S.P.D.C.). This information is arranged in two main categories: building performance/occupant satisfaction and survey analysis.

The S.P.D.C. is located on the upper three levels of the “Human Ecology” building on Michigan State University campus. The school houses offices, classrooms, studios, and common areas for the following departments: construction management, interior design, landscape architecture, and urban planning. For the data collection in this thesis study, the staff and faculty offices were included and all other spaces were excluded.

4.3.1.1 Overall Survey Response

The trial/initial POE survey was distributed to 50 faculty and staff members in the School of Planning Design and Construction. The due date for the return of completed survey was a week from the day of distribution. Of the 50 surveys delivered, 29 surveys were completed and returned. The response rate for the S.P.D.C. was 56%. The remaining 21 surveys were not received due to some faculty/staff members travelling in the week when the surveys were distributed, some being on leave, and some because of having left the job or the building.

4.3.1.2 Survey Participant Information

The third section of the POE survey solicited specific information and is summarized in Figure 4.3. The purpose of collecting this information is to understand the occupant population in the building evaluated. Additionally, it also helped to understand the description of respondents' workspaces, their job descriptions, and the maximum hours they typically spent in the building working from within their personal workspace. This helped to better understand their functional requirements.

Overall, the responses were received from two broad categories. One, where 55% of survey respondents were full-time employees, who have spent more than thirteen years in the same building and about a year in their present personal workspace. The others have been in the building for less than three years and have been in their new workspaces for more than a year.

Most respondents (59%) were faculty who had enclosed private offices. The rest are administrators and staff who have either shared offices or cubicles with high partitions. The primary work activities of faculty involved: long hours of teaching and grading student's submissions, meetings with other faculty and students, telephone conversations, preparing for a class, frequent movement to classrooms and the mailroom, long hours of personal research work, and responding to emails. On the other hand, 41% of the staff would mostly spend time on computer related work and phone conversations. Most of them would also access the mailroom once a day.

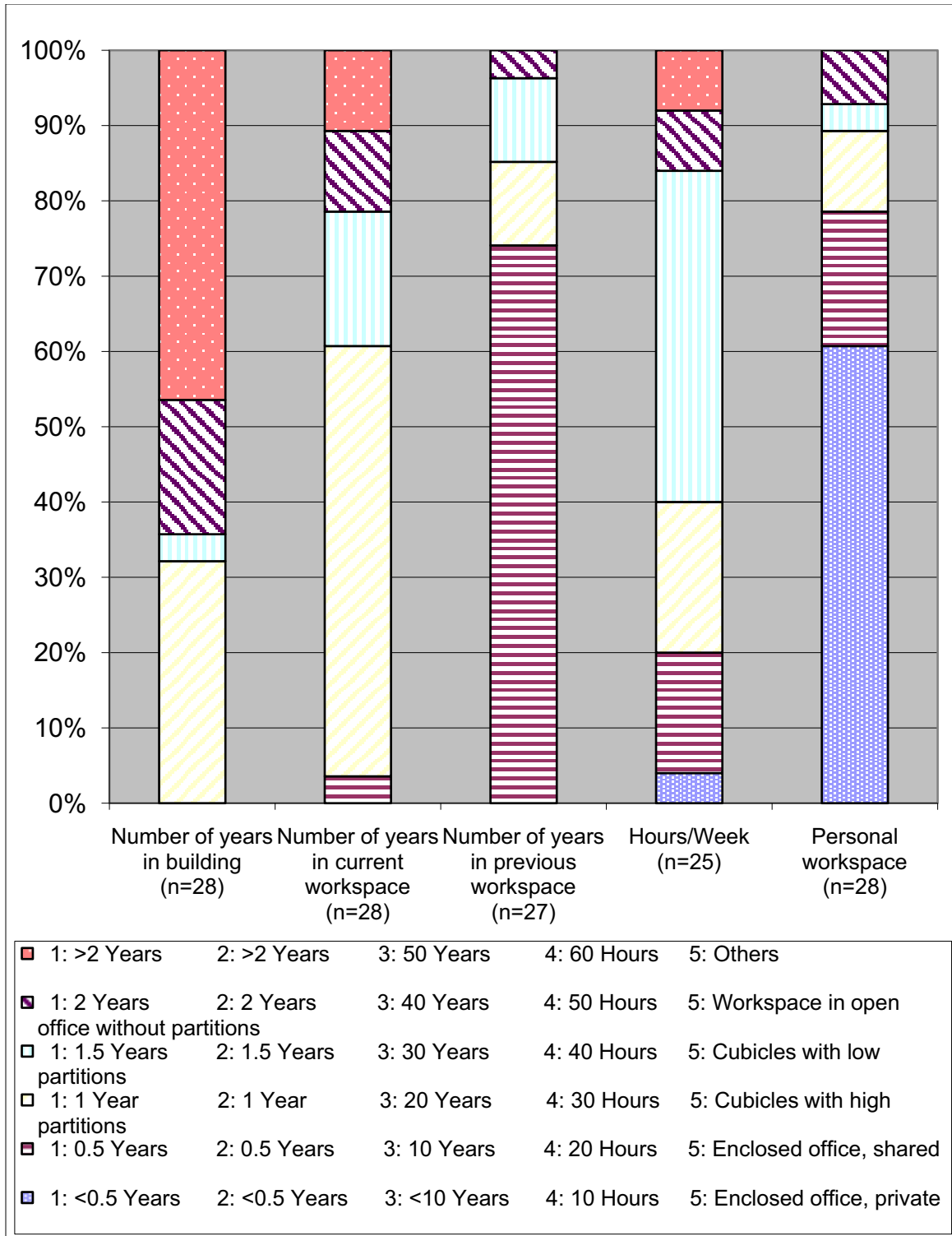


Figure 4.3: Participant and Workspace Information at S.P.D.C.

"For interpretation of the references to color in this and all other figures, the reader is referred to the electronic version of this thesis"

4.3.1.3 Building Specific Information and Analysis

This section presents a discussion of the building specific findings from the analysis of the S.P.D.C. survey responses. These findings are laid out in the order of the different sections in the survey.

A. Functional Performance

Functional performance in this study encompasses all those physical and visible aspects that may impact the satisfaction of university faculty and staff. It was found that 54% of occupants were satisfied or very satisfied with the overall functional performance of their workspace and 10% were dissatisfied or very dissatisfied. The remaining 36% were a little satisfied, little dissatisfied, or neutral. This assessment was based on space performance, ease of interaction with co-workers, privacy, office interiors, and accessibility. Individual responses with regard to the functional factors are summarized in Figure 4.4.

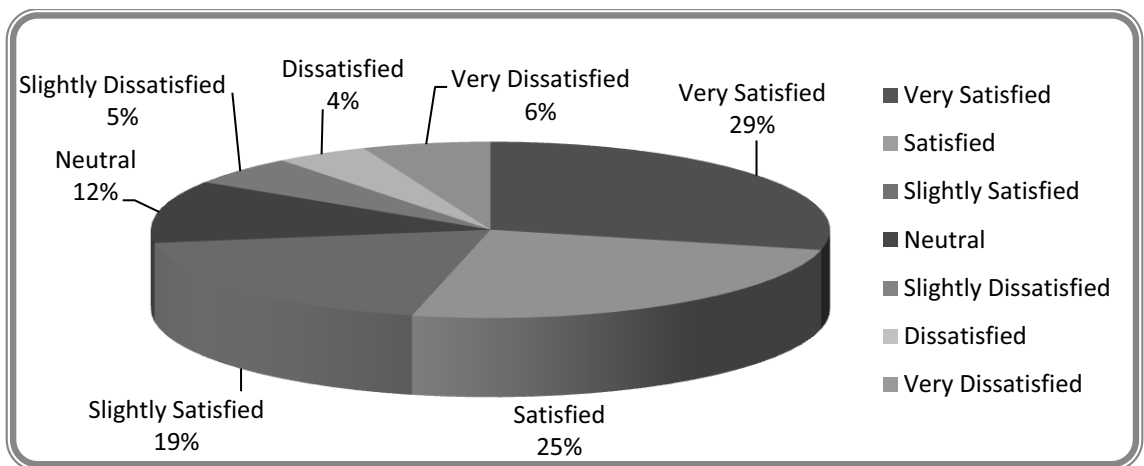


Figure 4.4: Occupant Satisfaction with Functional Performance at the S.P.D.C.

In order to simplify the assessment of occupant satisfaction, certain similar factors were combined together. The first factor, *space*, in Figure 4.5 includes office layout, the amount of space for function, storage, and location of personal workspace. The third factor, *privacy*, includes overall and visual privacy. The fourth factor, *office interiors*, includes furniture layout, furnishing, and office equipment.

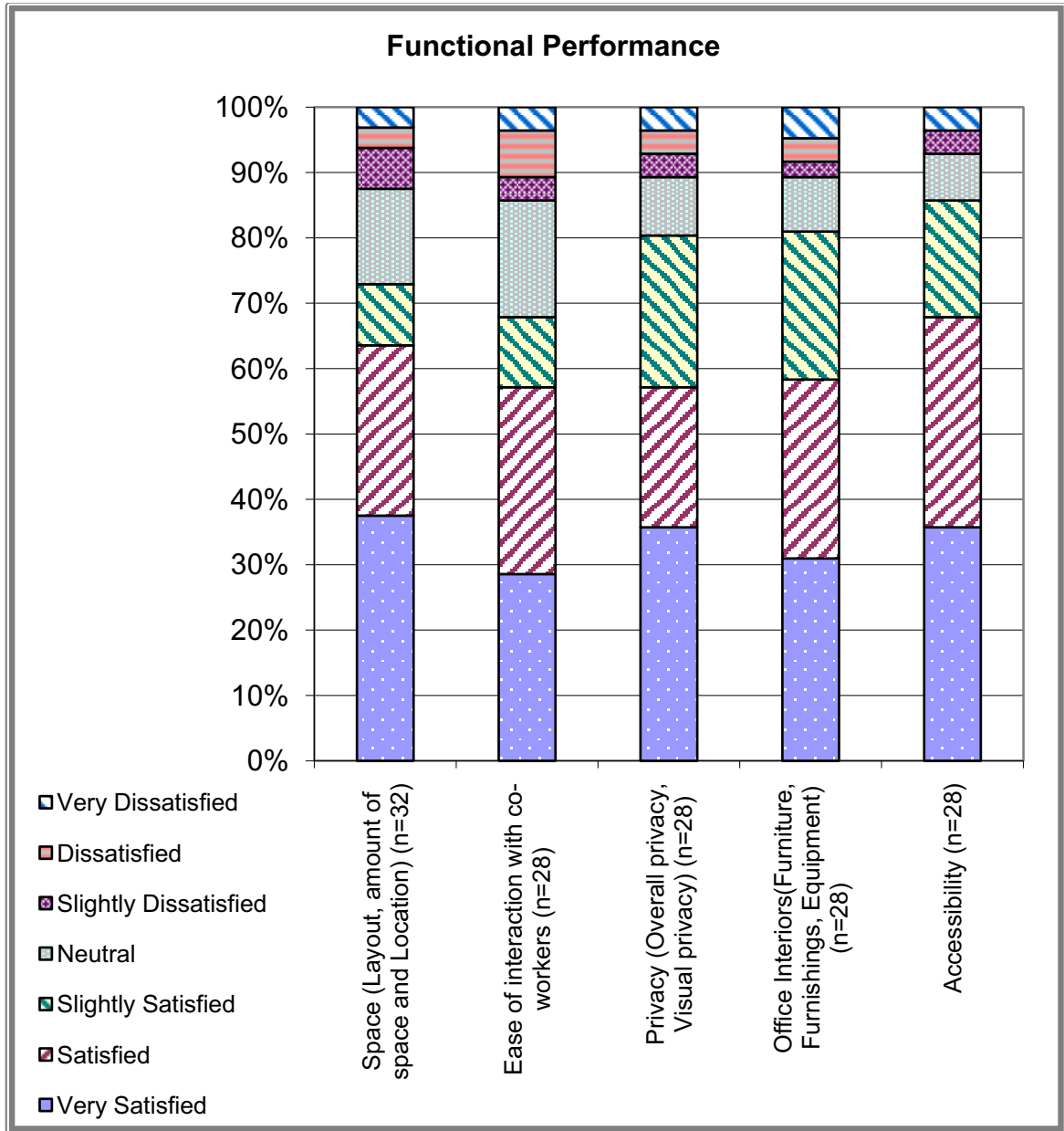


Figure 4.5: Occupant Satisfaction Level with Functional Performance Aspects at the S.P.D.C.

B. Indoor Environmental Performance

Indoor environmental performance in this study encompasses all those environmental aspects that may impact the satisfaction of university faculty and staff. As shown in the Figure 4.6, 45% of occupants were satisfied or very satisfied with the overall indoor environmental performance of their workspace and 15% were dissatisfied or very dissatisfied. The remaining 40% were little satisfied, little dissatisfied, or neutral. This assessment was based on lighting, thermal comfort, air quality, acoustic, and access and ability of personal control. The details of individual responses are presented in Figure 4.7.

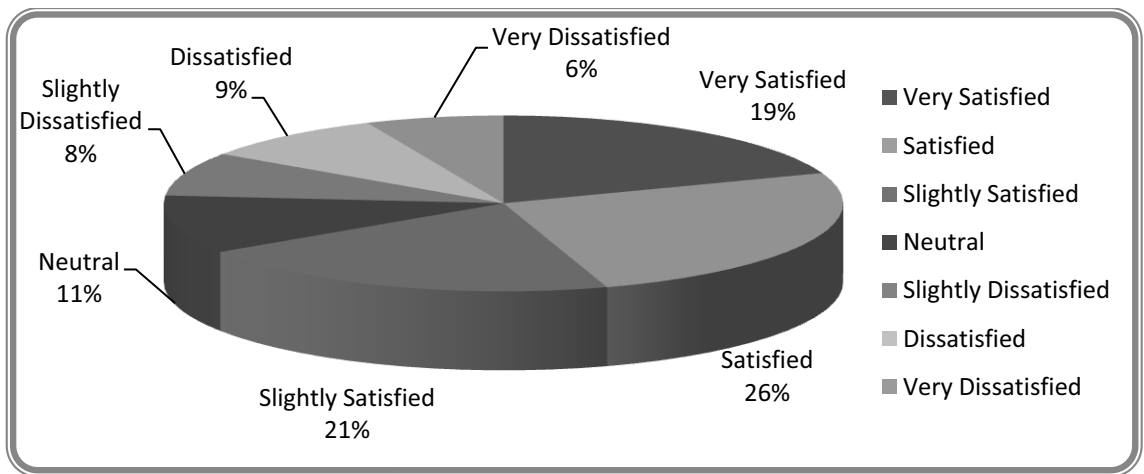


Figure 4.6: Occupant Satisfaction with Indoor Environmental Performance Aspects at S.P.D.C.

In order to simplify the assessment of occupant satisfaction, certain similar factors were combined together. The first factor, *lighting*, in Figure 4.7 includes natural lighting, artificial lighting, visual comfort, and overall lighting comfort. The second factor, *thermal comfort*, includes temperature, humidity, ventilation, and overall thermal comfort. The third factor, *air quality*, includes air quality and ventilation. The fourth

factor, *acoustic*, includes noise level and sound privacy. The fifth factor was *access and the ability of personal control for HVAC* had the highest dissatisfaction level.

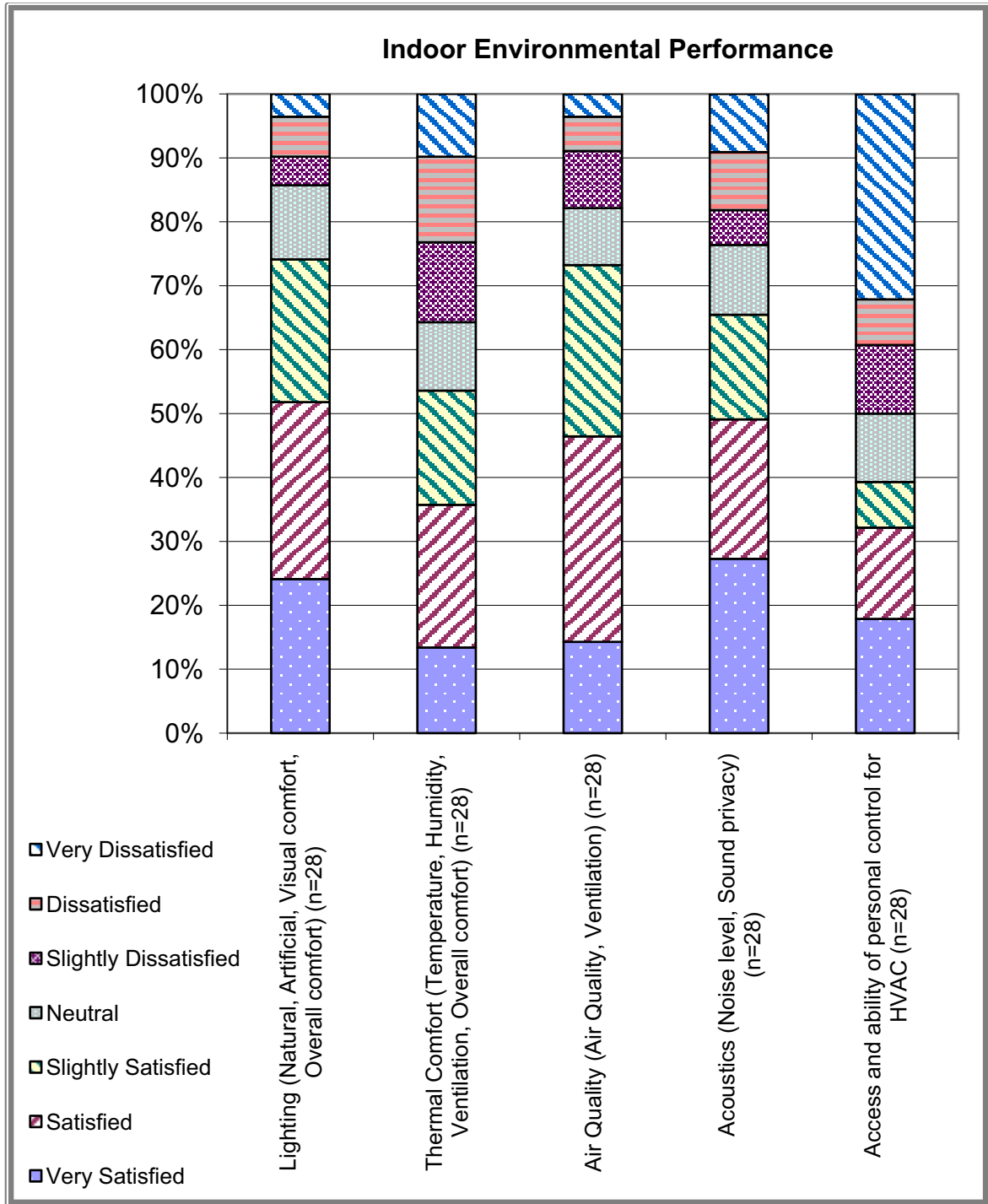


Figure 4.7: Occupant Satisfaction Level with Indoor Environment Performance at the S.P.D.C.

C. Discussion of Open-Ended Responses

This section presents a discussion of the open-ended responses from the S.P.D.C.. The open ended responses highlight occupants' perceptions with regard to the different existing building problems. A count of the total number of open-ended responses in each category is presented in Table 4.1.

Functional Performance Evaluation Factors	Number of Responses
Space: Office layout, amount of work and storage space, location of workspace	10
Ease of interaction with co workers	8
Accessibility	3
Access and ability to personal control	12
Corporation of user needs	12
Indoor Environment Performance Evaluation Factors	Number of Responses
Light: Natural lighting, Artificial lighting, Overall comfort	3
Thermal Comfort: Temperature, Humidity, Overall comfort	17
Air Quality: Air quality, Ventilation	1
Acoustic: Noise level, Sound privacy	8

Table 4.1: Count of Open-Ended Responses at the S.P.D.C.

Space: Overall, ten occupants perceived that the physical space for work and storage in offices was not enough. The workspace layout did not perform well for some occupants to feel satisfied. Faculty members complained that space was not sufficient enough to store students' assignments or teaching materials.

Ease of interaction with co-workers: The ease of interaction with co-workers for some faculty and staff is not satisfactory. Faculty members who work with graduate students on research stated that they would prefer being in close proximity to their respective students so that effective communication can happen without time and tempo being wasted in movement. For some faculty and staff members, the layouts of offices prevent necessary communication. Often there is a sense of isolation among certain members. For staff, since they have a regular set of activities, their ability to quickly interact with others gives them a sense of connection and relaxation without wasting too much time being wasted. Overall, eight occupants mentioned the need for improvements that would facilitate necessary and effective interaction between staff and faculty.

Accessibility: Occupants on the fourth floor expressed dissatisfaction with regard to lack of elevator access to the fourth floor of the building. However, any modification for access to the elevator was not a part of the renovation scope at S.P.D.C.

Access and ability to personally control temperature: This is a very sensitive aspect among most occupants and is the greatest factor for occupant dissatisfaction (Figure 4.4).

Twelve occupants stated that there is no personal control and that it is either too hot or too cold in their workspace.

Incorporation of user needs: Twelve occupants indicated that they did not feel their needs were incorporated as they were still dissatisfied with the lack of physical space and storage space after renovation. This finding should ideally be compared with the renovation scope which was defined in the beginning of the project.

Light: Most occupants are satisfied with overall lighting of their workspace. Only three occupants indicated a problem with the light sensors in certain areas which causes the light to turn off in workspace or surrounding corridors due to lack of movement when most faculty are within their offices or are away in classrooms.

Thermal Comfort: This factor is the second greatest cause of occupant dissatisfaction (Figure 4.4). Seventeen occupants stated that they either needed individual HVAC units or personal control for adjusting the temperature in their workspaces, but only if a centralized unit was being used.

Air Quality: A majority of occupants are satisfied with the air quality and no significant responses were noted in the open-ended section.

Acoustics: Eight occupants who responded to the open-ended section for this factor stated that they were not satisfied with the acoustic of their workspace. Occupants stated

that telephone or in-person conversations could be overheard due to poor acoustics, which hinders work performance. The data showed that most of these occupants were seated in open-offices.

New Technology: The data indicated that there were no special new technologies installed or used in the S.P.D.C. The only element installed were light sensors, which turned out to be a source of dissatisfaction for some occupants.

4.3.1.4 Survey Feedback Analysis: (Section 4 of the POE Questionnaire)

This section presents the summary of findings from the survey feedback analysis. The total percentage of positive response to the overall trial POE survey was 70%, which is the average of responses to Questions 1, 2, 6, 7, and 9 in section 4 of the POE survey. A portion of the trial survey was used to improve the final survey presented in Chapter 5 using the suggestions given by the occupants during the POE.

85% of the S.P.D.C. occupants completed the survey in less than 30 minutes. The remaining population took more than 30 minutes or did not respond to the question. On average, the S.P.D.C. occupants completed the POE survey between 20-30 minutes.

As shown in the following figures, 56% were very satisfied or satisfied with the format of the survey (Figure 4.8), 55% were satisfied with the appropriateness of questions (Figure 4.9), 89% were satisfied with the extent to which the aspects are covered in the POE survey (Figure 4.13), 82% said yes to the question, “Are the right questions being asked?” (Figure 4.14), and 67% said yes when asked if the POE survey

allowed them to effectively indicate their satisfaction with the design of their workspace (Figure 4.15).

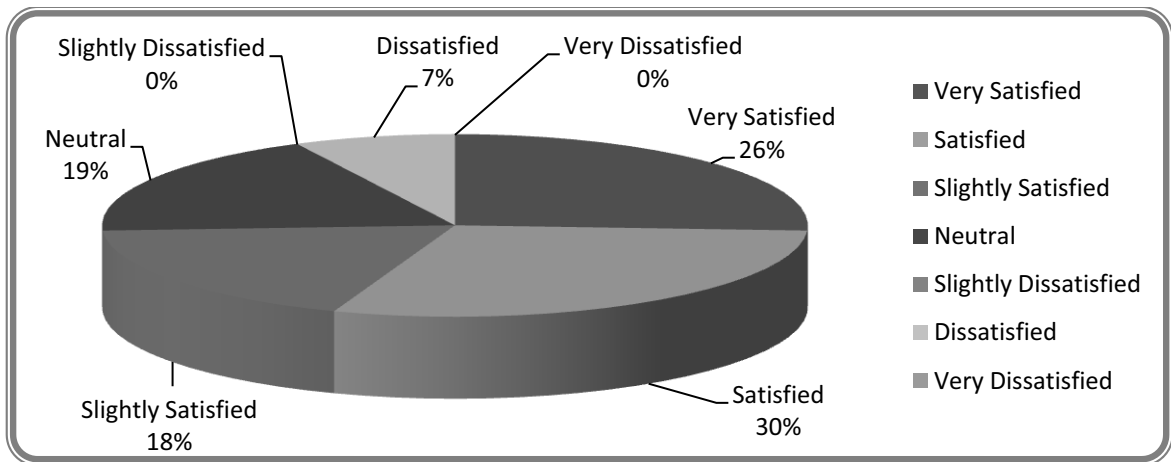


Figure 4.8: Q1: How satisfied are you with the format of the survey?

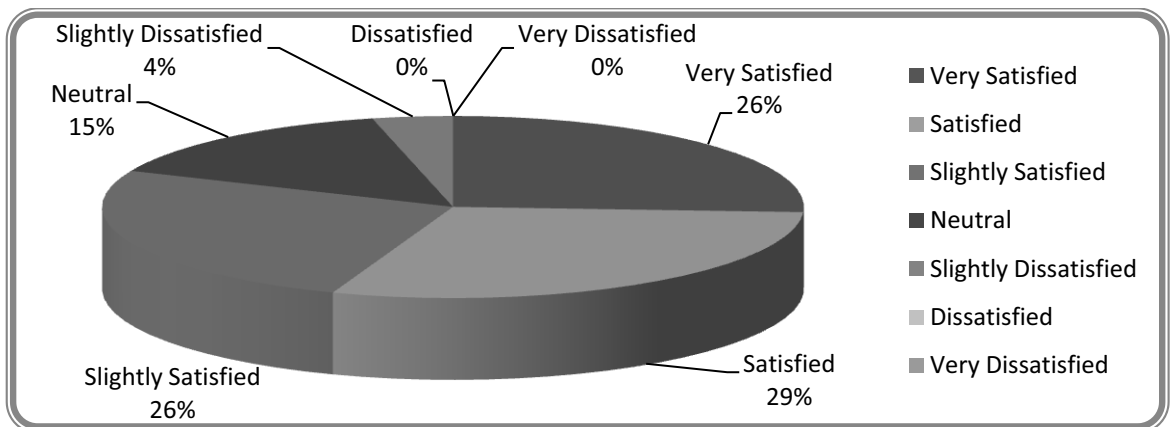


Figure 4.9: Q2: How satisfied are you with the appropriateness of the questions?

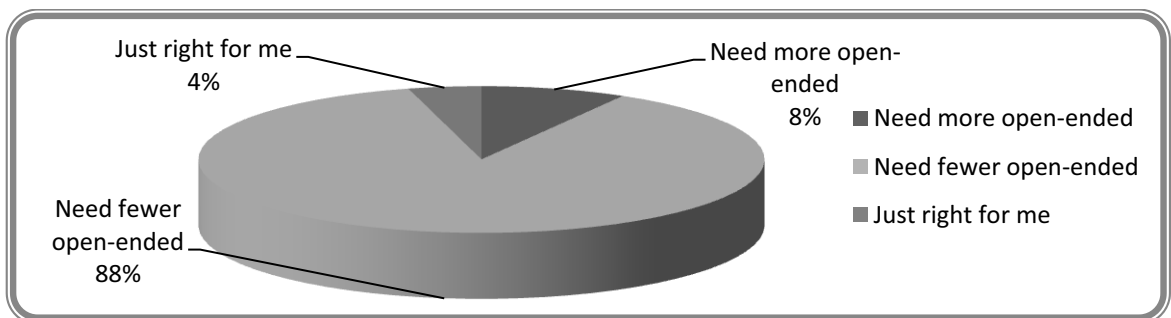


Figure 4.10: Q3: Please comment on the balance of open ended to closed response questions.

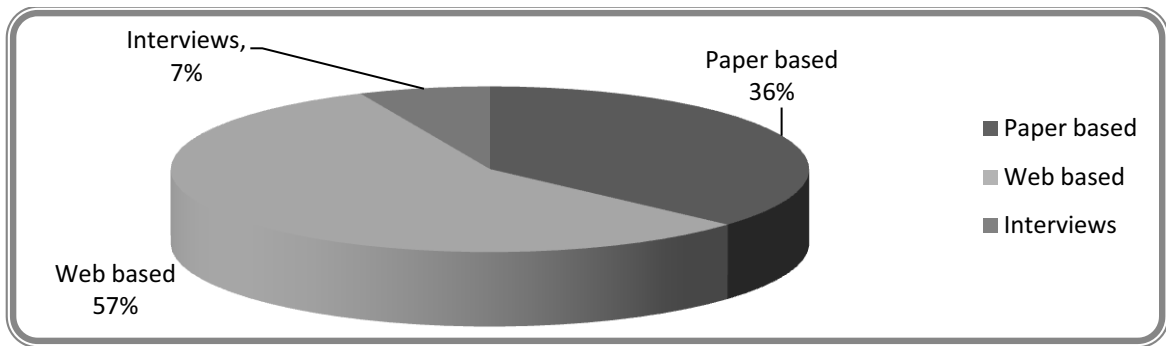


Figure 4.11: Q4: In the future, which method of interaction would you prefer for this kind of study?

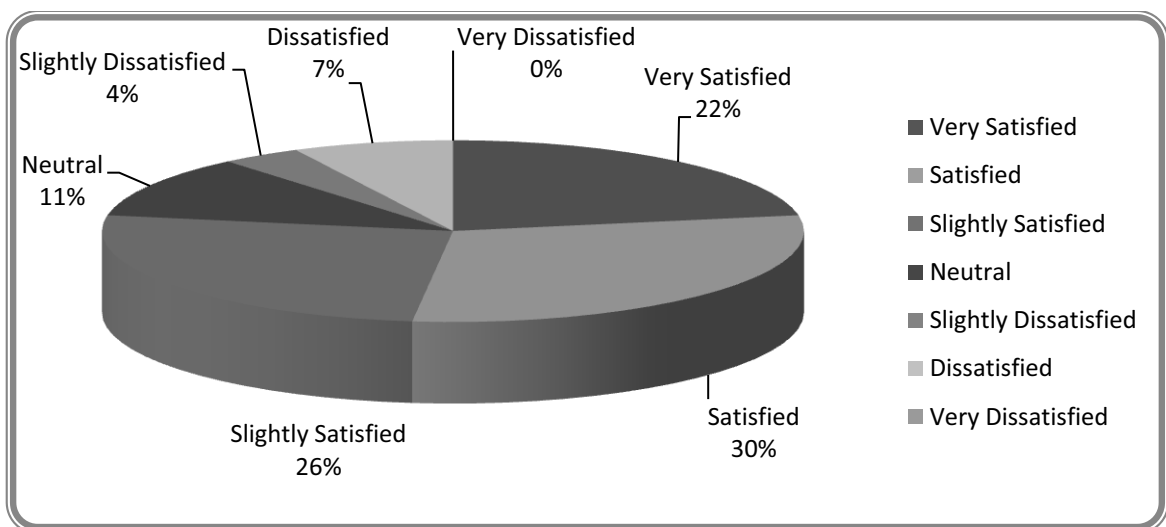


Figure 4.12: Q5: In your opinion, to what extent did the survey cover aspects that you would like to comment upon about your office?

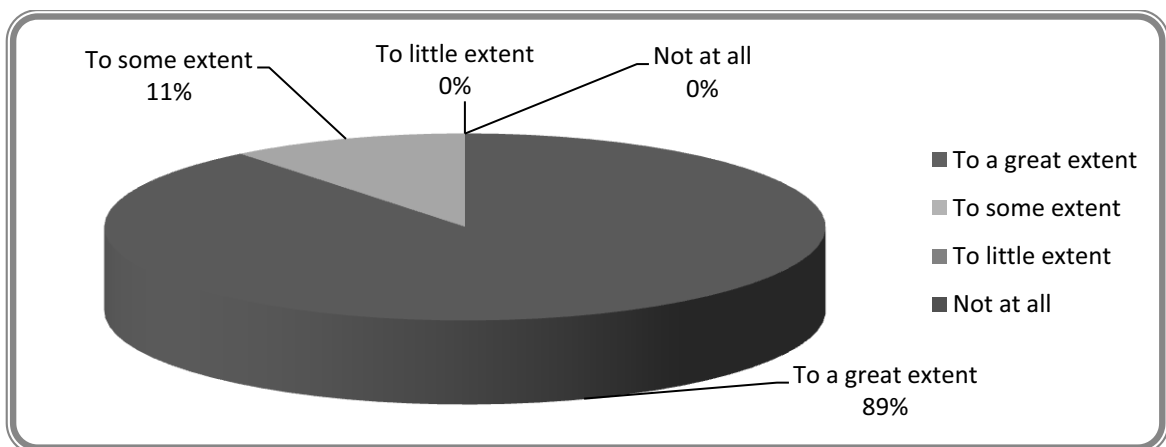


Figure 4.13: Q6: In your opinion, to what extent did the survey cover aspects that you would like to comment upon about your office?

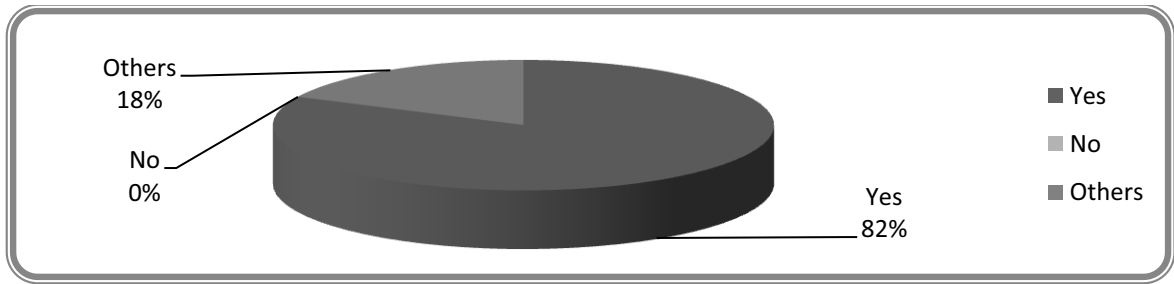


Figure 4.14: Q7: Do you consider that right questions are being asked of building occupants?

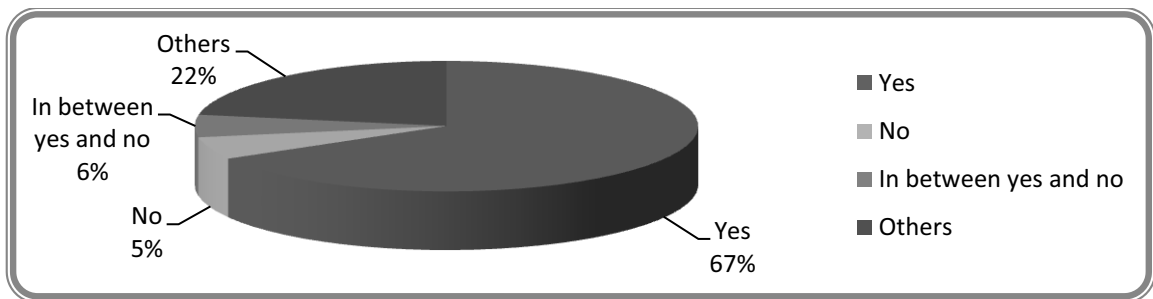


Figure 4.15: Q8: Does the survey allow you to effectively indicate your satisfaction with the design of your workspace?

4.3.1.5 Occupant Observations, Suggestions and Recommendations

This section presents excerpts from the survey feedback section to bring forth the observations, suggestions, and recommendations of the S.P.D.C. occupants:

- One faculty member stated, “The use of ‘satisfaction’ phrase is vague to me. It does not capture my feelings although there is plenty of opportunity to relate concern in the open-ended portion. Ask questions about what occupants like, since all questions encourage respondents to find faults. Space satisfaction is closely related to overall management and job duties more questions about this.”
- Another faculty member mentioned that “generally the likert scale starts from ‘very dissatisfied’ to ‘very satisfied’ rather than ‘very satisfied’ to ‘very dissatisfied’ as given in the trial POE survey”.

- Two other faculty members suggested that questions be added in the POE survey for evaluation of teaching spaces, studios, computer lab space, common areas, and lunch rooms. With regard to the building they stated that student meeting rooms should be provided on every floor to avoid time wasted in unnecessary movement. Please note that student spaces were not in the scope of this study.
- One said-“The workspace overall is not fully encouraging for interaction. It does not provide full privacy when needed. The building does not give common study areas to students or faculty. Please consider flexibility of the space for use in future.
- One of the faculty members suggested that in order to give more flexibility to respondents, question 38 in the first section should have a fifth option which will represent negative impact on performance.
- In the fourth section, another faculty member commented in response to Question 6 -“Why would I be satisfied about it? If you are asking if I would volunteer for it- Yes”, and Question 10-“In between yes and no”. All yes-no questions

4.3.2 CASE STUDY NO.2

SPARTAN WAY

This section and following sub sections presents a discussion of the survey findings from Spartan Way with regard to building performance and survey.

Spartan Way is located in the stadium facility on Michigan State University campus. Spartan Way consists of offices, conference rooms, multipurpose rooms, and common areas for various groups that support multiple services provided for and by MSU

employees, students, alumni, sponsors, etc. For the data collection in this thesis study, only the staff offices on third floor were included and all other spaces were excluded.

4.3.2.1 Overall Survey Response

The trial/initial POE survey was distributed to 115 occupants in Spartan Way, of which, 62 occupants (54%) responded. The time given to participants was one week from the day of distribution. Another week extension was given to occupants who had the intention but did not have the time to respond to the survey earlier. Out of remaining occupants some chose not to participate, some were on leave and some were visiting alumni. Unfortunately, it was realized after all the returned survey was recorded that the second page was missing for 19 occupants. Therefore, the survey second page was re-sent the next morning (Tuesday) with a letter of apology and requesting respective occupants to complete it and send it back if possible by Friday of that week. Finally, when no responses came back, the surveys were closed for analysis.

The 19 surveys that had the second page missing, consequently were missing responses for questions 8 through 19. Therefore, those surveys were completely excluded in the analysis of “Function performance” as shown in Figure 4.17. The survey responses were included in the “Indoor Environmental Performance” which is shown in Figure 4.19.

4.3.2.2 Survey Participant Information

This section presents the Spartan Way respondent information gathered and summarized in Figure 4.16. As mentioned, the purpose of collecting this information was

to understand the occupant population in the building that was being evaluated. Additionally, it also helped to understand the description of their workspace, their job description, and the maximum hours they spend in the building working from their personal workspace. This also helped to understand the occupants' functional requirements.

The Spartan Way occupant population was 79% female and 15% male; the rest 6% chose not to respond to that question. 82% of the occupants (n=62) were between 30-70 years of age. All occupants were full-time staff workers with no faculty responsibilities. 84% of the occupants had spent one year or more in their respective workspaces and 92% in their building. 68% of the occupants were located in cubicles or open office areas and 31% were located in enclosed private offices. Enclosed private offices were mainly provided for administrators. The primary work activities of occupants involved long hours at the computer, frequent and intense telephone conversations, long hours of reading, researching, writing, meetings, walking to and from the mail room, technical assistance, walking across campus to other departments, frequent movement within building, auditing, etc. Unlike S.P.D.C., the overall activities for occupants in this building were more uniform.

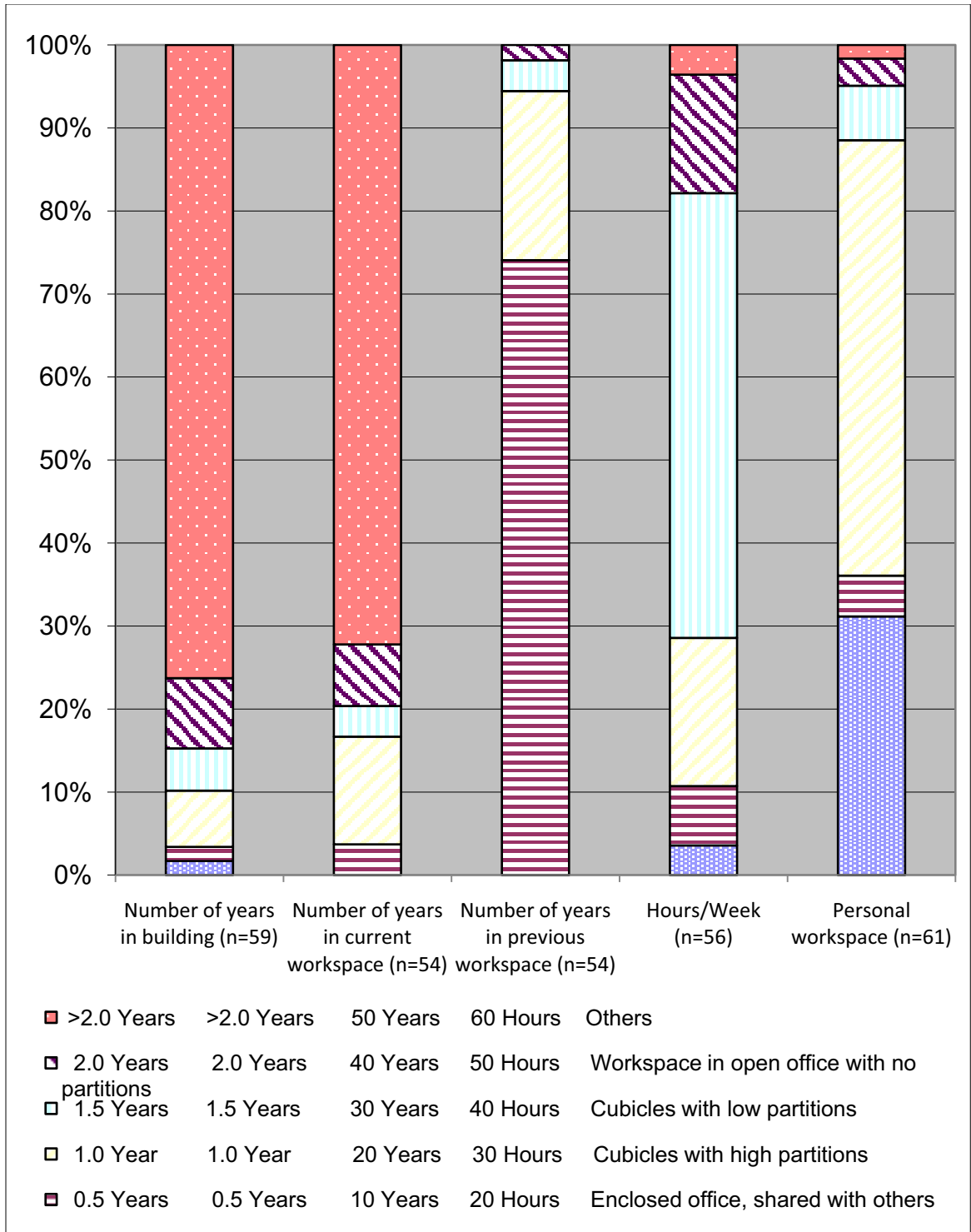


Figure 4.16: Participant and Workspace Information at Spartan Way

4.3.2.3 Building Specific Information and Analysis

This section presents a discussion of the building specific findings from the analysis of the Spartan Way survey responses. These findings are laid out in the order of the survey sections.

A. Functional Performance

Functional performance in this study encompasses all those physical and visible aspects that may impact the satisfaction of university faculty and staff. As shown in Figure 4.17, it was found that 50% of the occupants were satisfied or very satisfied with the overall functional performance of their workspace and 12% were dissatisfied or very dissatisfied. The remaining 38% of the occupants were little satisfied, little dissatisfied, or neutral. This assessment was based on space performance, ease of interaction with co-workers, privacy, office interiors, and accessibility. Individual responses with regard to the functional factors are summarized in Figure 4.18.

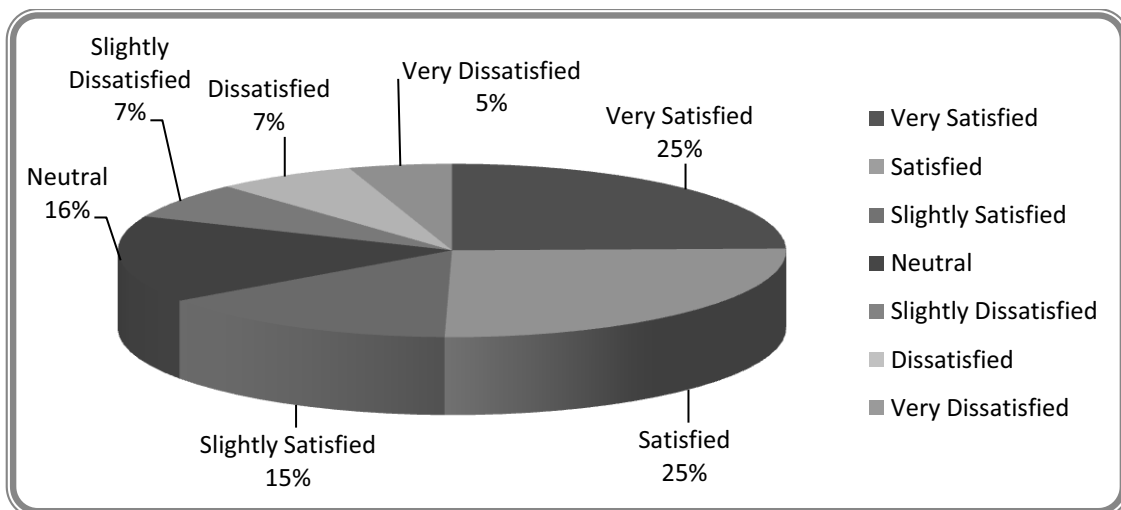


Figure 4.17: Occupant Satisfaction with Functional Performance at the Spartan Way

In order to simplify the assessment of occupant satisfaction, certain similar factors were combined together. As shown in Figure 4.18, the first factor, *space*, includes office layout, amount of space for function and storage and location of personal workspace; the second factor is *ease of interaction with co-workers*; the third factor, *privacy*, includes overall and visual privacy; the fourth factor, *office interiors*, includes furniture layout, furnishing and office equipment; the fifth factor is *accessibility*.

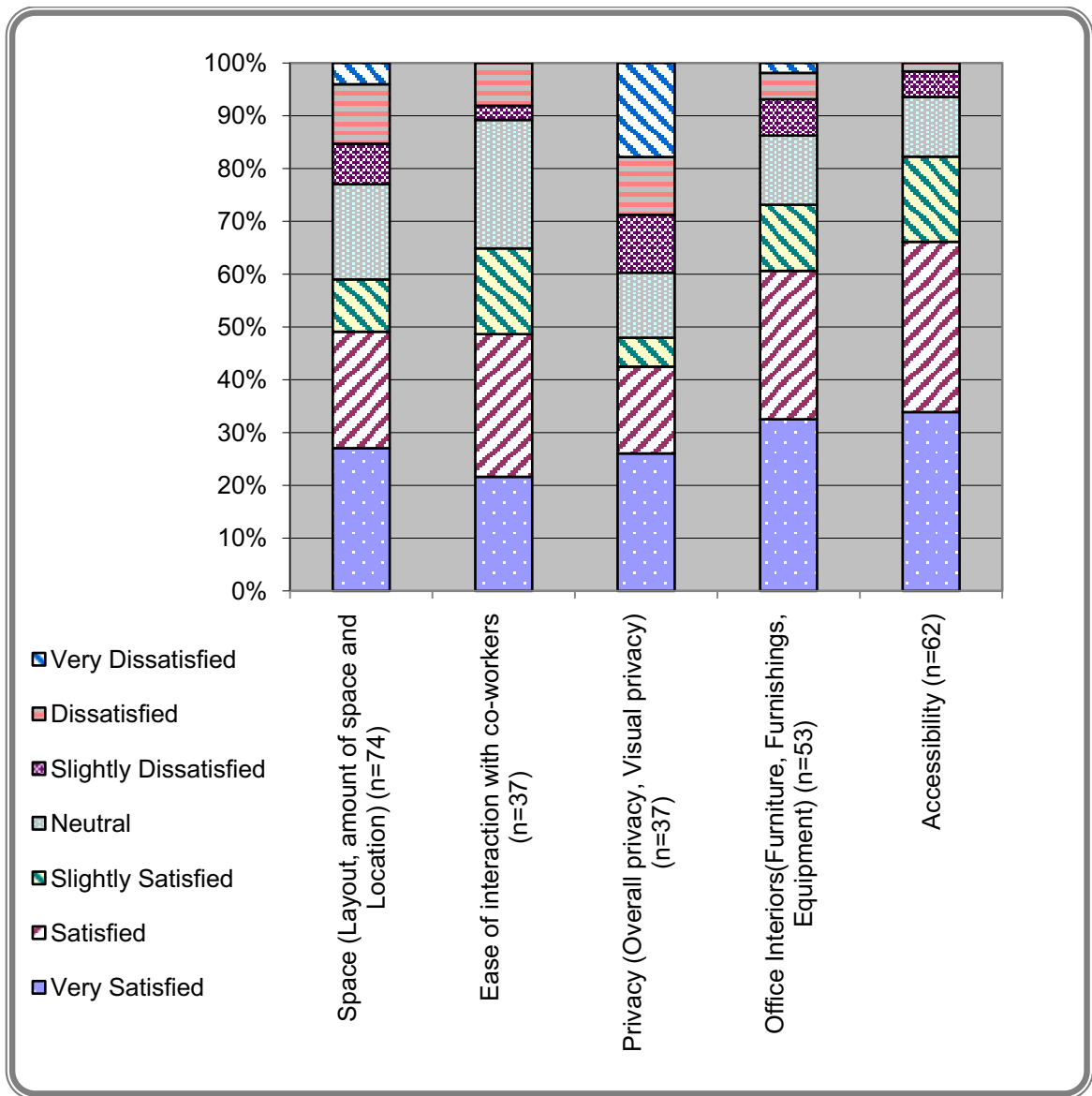


Figure 4.18: Occupant Satisfaction Level with Functional Performance Aspects at Spartan Way

B. Indoor Environmental Performance

Indoor environmental performance in this study encompasses all those environmental aspects that may impact the satisfaction of university faculty and staff. As shown in the Figure 4.19, 38% of the occupants were satisfied, very satisfied with the overall indoor environment performance of their workspace, and 19% were dissatisfied or very dissatisfied. The remaining 43% were slightly satisfied, slightly dissatisfied or neutral. This assessment was based on lighting, thermal comfort, air quality, acoustics, and access and ability of personal control. The responses with regard to each factor are presented in the Figure 4.20.

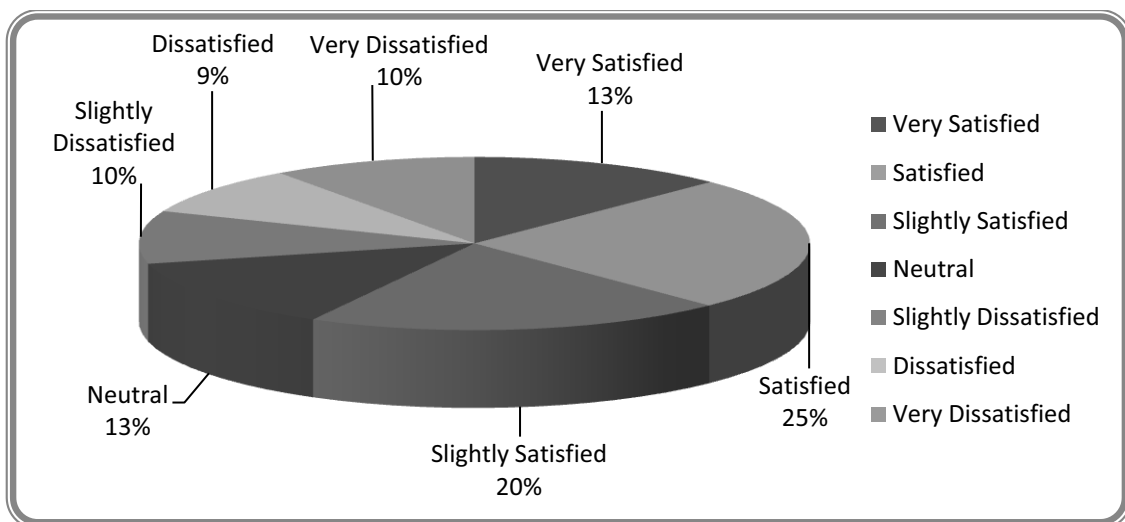


Figure 4.19: Occupant Satisfaction Level with Indoor Environmental Performance Aspects at Spartan Way

In order to simplify the assessment of occupant satisfaction, certain similar factors were combined together. The first factor, *lighting*, in Figure 4.20 includes natural lighting, artificial lighting, visual comfort and overall comfort. The second factor, *thermal comfort*, includes temperature, humidity, ventilation and overall comfort. The third factor, *air quality*, includes air quality and ventilation. The fourth factor, *acoustics*,

includes noise level and sound privacy. The fifth factor was *access and the ability of personal control for HVAC*.

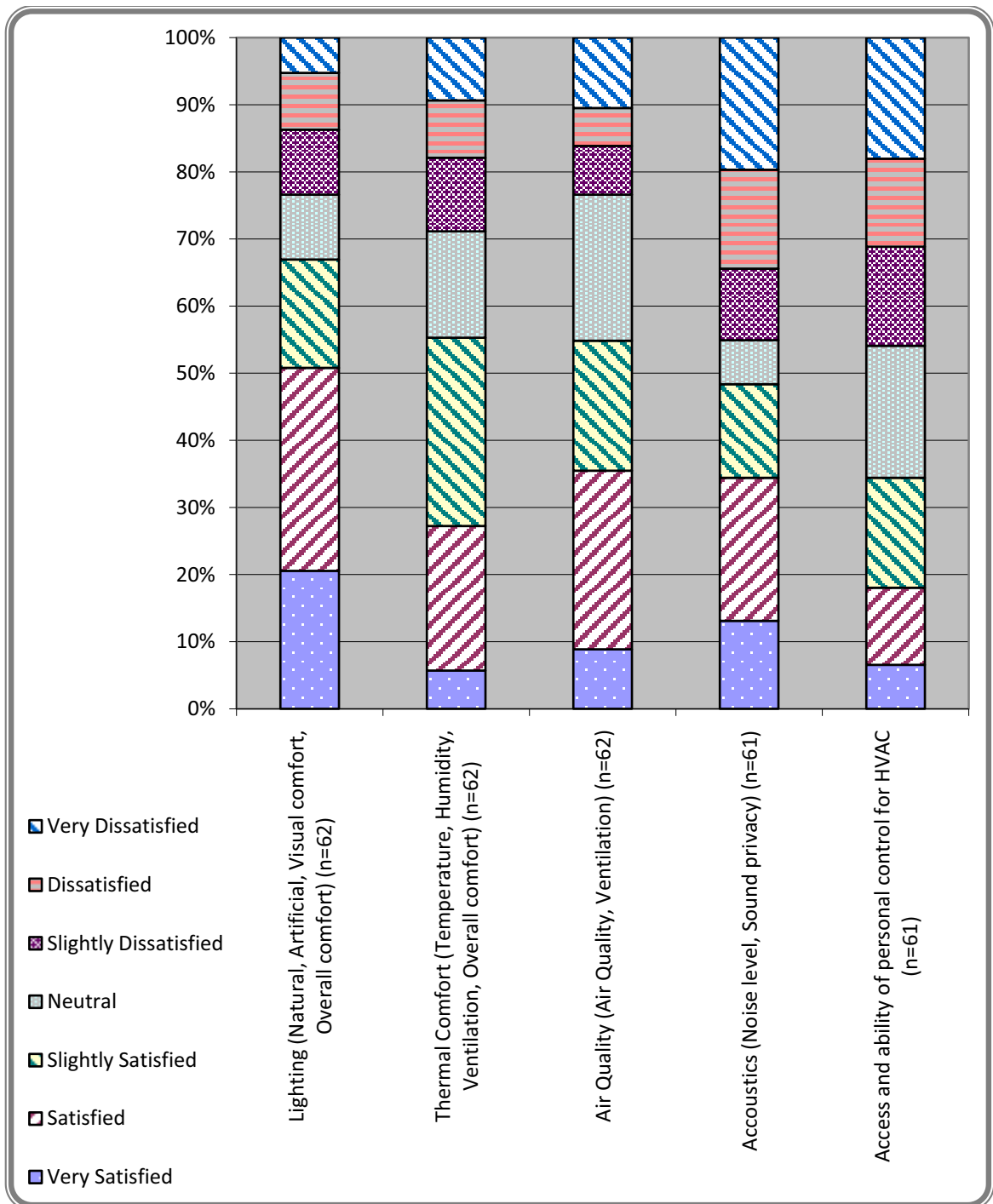


Figure 4.20: Occupant Satisfaction Level with Indoor Environment Performance at Spartan Way

C. Discussion of Open-Ended Questions

This section presents a discussion of the open-ended responses from the Spartan Way. The open-ended responses highlight occupant's perception with regard to the different existing building problems. A count of the total number of open-ended responses in each category is presented in Table 4.2.

Functional Performance Evaluation Factors	Number of Responses
Space: Office layout, amount of work and storage space, location of workspace	25
Ease of interaction with co workers	8
Privacy	13
Office Interiors	29
Accessibility	4
Access and ability to personal control	26
Window view and location	16
Corporation of user needs	26
Indoor Environmental Performance Evaluation Factors	Number of Responses
Light: Natural lighting, Artificial lighting, Overall comfort	14
Thermal Comfort: Temperature, Humidity, Overall comfort	27
Air Quality: Air quality, Ventilation	15
Acoustic: Noise level, Sound privacy	23
Work activities	39
Survey	18

Table 4.2: Count of Open-Ended Responses at Spartan Way

Space: A total of 25/62 occupants responded when asked about the aspects that they would change to improve the functional performance of their personal workspace and

stated that they need “complete departments to reside alongside each other within talking or seeing distance”, that the desk and movement area within each cubicle is insufficient, that distance between particular work spaces and office equipment areas containing printers, fax machine, and mail boxes is too large, that the storage space and units are insufficient, and that the space allocation is disproportionate; as quoted by one of the occupants, “huge offices vs. tiny cubicles”. Another occupant commented, “This office is poorly laid out. I think it is odd that this place was designed with so many cubical designated for people who are not fundraisers nor supervisors and so few offices. We have areas with many empty cubes and then areas where we can’t even have all the staff of the unit together. I also think it’s odd that so many small conference rooms were designed without having one large one. We have to spend money to rent other facilities every time we have a meeting with more than maybe five people, which is quite ridiculous for a unit as large as ours”.

Ease of interaction with co-workers: This is one of the most significant causes for occupant dissatisfaction with functional performance. Occupants stated, “The long hallway design isolates people” and “it would be nice to be in an area all together, where we can interact without worrying about disturbing others around us.”

Accessibility: Some of the occupants consider the main entrance to be very far from their personal workspace and some stated, “It is a long walk from the parking lot and up a lot of steps. It is okay for a young healthy person but could be difficult for an old or injured person”. One of the occupants considers that the building has higher than usual security.

Access and ability of personal control: This is another one of the most significant causes of occupant dissatisfaction among all other evaluation factors in Spartan Way. Out of the 26 open-ended responses received, some occupants stated the following:

- “We have no control on temperature of office, so therefore it can be too cold or too warm at times.”
- “I need to purchase a heater (my own). I seem to be cold most days.”
- “There is no control for heating and ventilation, even if we all agree we are hot, we can’t change the thermostat.”
- “It is always too hot in winter likewise in summer. No personal control is available.”
- “Only problem is temperature. Personal heaters are a must.”
- “We constantly have heating/ cooling issues. Generally too cold all year round.”
- “Personal office thermostat would be great.”

Incorporation of user needs: Only 5/26 occupants responded positively to the incorporation of user needs. The rest of them stated the following:

- “We were not given an opportunity to provide input. Ladies restroom location is not convenient or adequate. Always better to work in better surroundings.”
- “I am not sure the needs of employees were considered at all. Functionality of location, storage, counter-space for project meetings.”
- “No. Not really. The space is pretty generic.”

- “I have no idea what renovations occurred. If this is about Spartan way, then my major concern is the terrible acoustics in the café lounge.”
- “No. Privacy issues, noise levels and layout of computer were all ignored.”
- “No. There no privacy, the work area is too small, the lighting is too bright. When we first came here they said that we in cubes could use the chat rooms when we need a bit of privacy. However, because they designed so many cubes in relation to offices, the chat rooms have long ago been converted to offices.”

Light: Though Spartan Way occupants are fairly satisfied with this aspect, some of them stated that the glare was too much due to the overhead lighting or when all the lights were switched on and that sometimes the glare from the sun was too bright during the afternoons. At least 5 occupants stated that they would prefer natural light.

Thermal comfort: The lack of access and ability to personally control temperature and a bad ventilation system has resulted in occupants being dissatisfied with the thermal comfort at Spartan Way. It seems from the comments of most occupants that this aspect is affecting the overall quality of the indoor environment at this building. Some of these comments are as follows:

- “I don’t like not having some control of my workspace temperature.”
- “Add humidity in the winter. Humidity is lower than 20% or less. A little more heat would help in cool weather.”
- “Ventilation is poor and there is no control over temperature.”

- “No control over temperature and ventilation. I just keep a sweater and try to dress in layers but the thermostats area joke.”
- “The air conditioning can be too cold and I feel it is a waste of energy.”
- “Eyes burn every day. Too hot one day, too cold the next.”
- “Can be hot, seems dry, smoke fumes and exhaust fumes come into private office- difficult when it happens due to asthma. Individual office controls for heating and cooling.”

Air quality: This aspect as well is a secondary cause of dissatisfaction as it is a result of the ventilation system. This has been concluded from the following comments:

- “Figure out where the ventilation is piped. Kitchen and bathroom odors are very prominent. Air does not seem to circulate well.”
- “Air purifier to remove dust would help. Some of us developed eye allergies. Being able to open windows in nice weather would help. More custodial service staff would be of help.”
- “The air quality in the bathroom on the third floor is terrible. It always smells bad. It smells like sewer back up air. This has been bad since day 1. Nothing seems to make it better.”
- “The first year or so, the odors from catering downstairs were almost a daily occurrence and sometimes we would actually see a haze in the air. This has been corrected and now there are only occasional aromatic days. Some days it is very humid and stuffy in here.”
- “Vent outside and have intake outtake apart from each other. Cold air returns.”

Acoustic: The open office plan and crowded layout is a cause of poor acoustical performance for this building. Most occupants were very concerned about the lack of sound privacy and noise level, which affected their work performance to some extent. Some of the comments that substantiate this conclusion are as follows:

- “You can hear every conversation in the office unless you are in one of the closed offices- even closed offices you can hear conversations.”
- “Any change would help sound privacy. We can hear people breathe. Phone conversations are impossible. Therefore, one has to leave workspace to go to a chat room- what if we need computer for conversations.”
- “It is not possible to professionally interview donors in an open space. Yet it is also not possible to interact with colleagues in order to consult on projects (disturbs others).”
- “Do not like the white noise machine. It needs to be turned down. It is not necessary.”
- “Everything echoes. You can hear conversations from down the hall and around the corner. Very hard to concentrate because of the noise. We were told we would have the state of the art noise reduction system- it doesn’t work.”
- “White noise is not covering the noise from co-workers and turning the white noise up has resulted in feeling like your working in an airplane all day.”
- “Not only can I all hear other people's conversations but mine are heard by others. Also often, I am interrupted by others during phone conversations. As much as I do not like my office environment, but I do not let it affect my work.”

- “Office size is wonderful but in high traffic area so need to close door. Windows (clear) in door would be good. Then I appear sociable accessible but can get down on high traffic noise. To work productivity and to be able to concentrate and focus, I need to shut door to shut out noise.”

New technology: As seen in the above mentioned comments, the white noise system which was suppose to act as a noise reduction system is actually causing additional noise in the office area which disturbs the workers and leads to a dissatisfied temperament. This leads to the understanding that the new technology has failed to accomplish the intended purpose.

4.3.2.4 Survey Feedback Analysis: (Section 4 of the POE Questionnaire)

This section presents the summary of findings from the survey feedback analysis. The total percentage of positive response to the overall trial POE survey was 71%, which is the average of responses to Questions 1, 2, 6, 7, and 9 in section 4 of the POE survey. This trial survey will be further improvised using the suggestions given by the occupants during the POE.

In Spartan Way, 41% were satisfied with the format of the survey (Figure 4.21), 53% were satisfied with the appropriateness of questions (Figure 4.22), an overall 94% consider that aspects are covered to a great extent/some extent by the POE survey (Figure 4.26), 82% said yes to the question, “Are the right questions being asked?” (Figure 4.27), and 85% said yes when asked if the POE survey allowed them to effectively indicate their satisfaction with the design of their workspace (Figure 4.28).

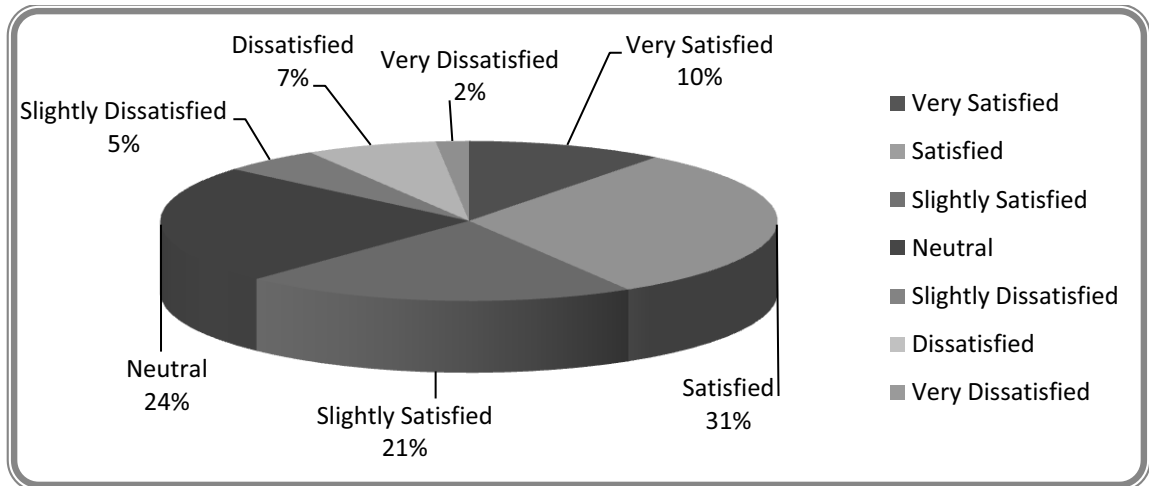


Figure 4.21: Q1: How satisfied are you with the format of the survey?

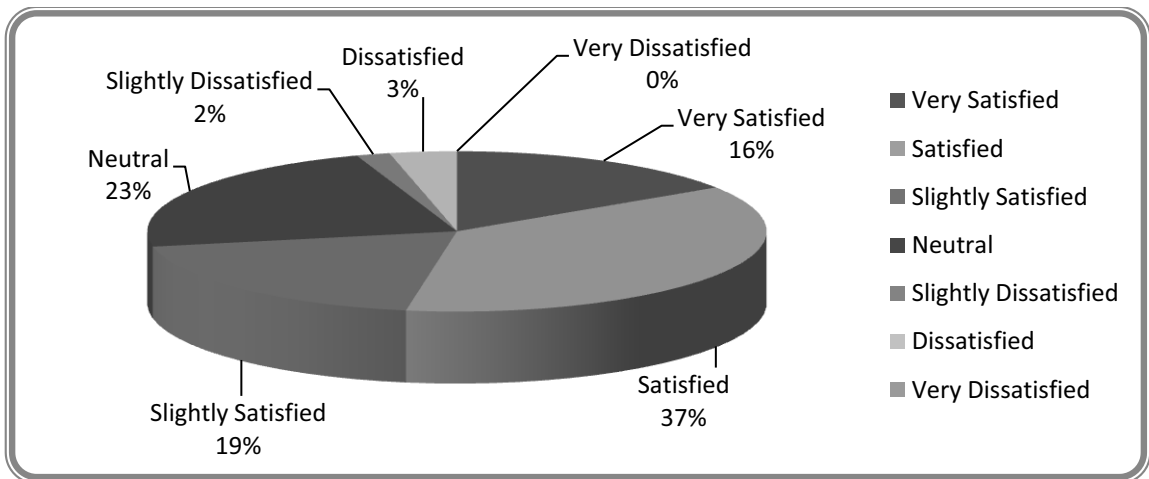


Figure 4.22: Q2: How satisfied are you with the appropriateness of questions?

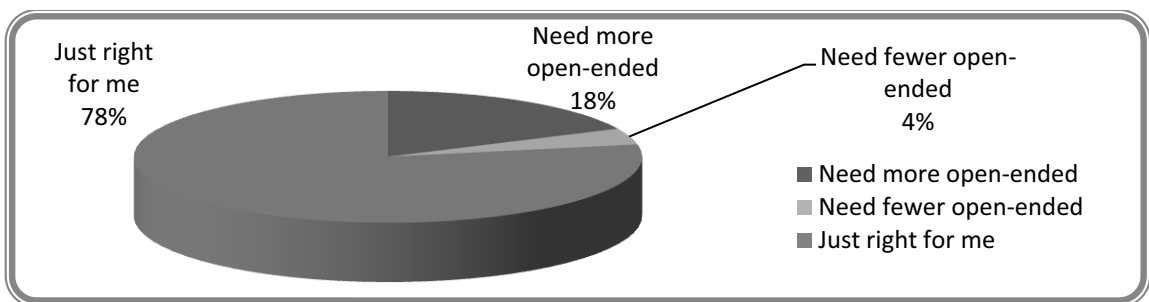


Figure 4.23: Q3: Please comment on the balance of open ended to closed response questions.

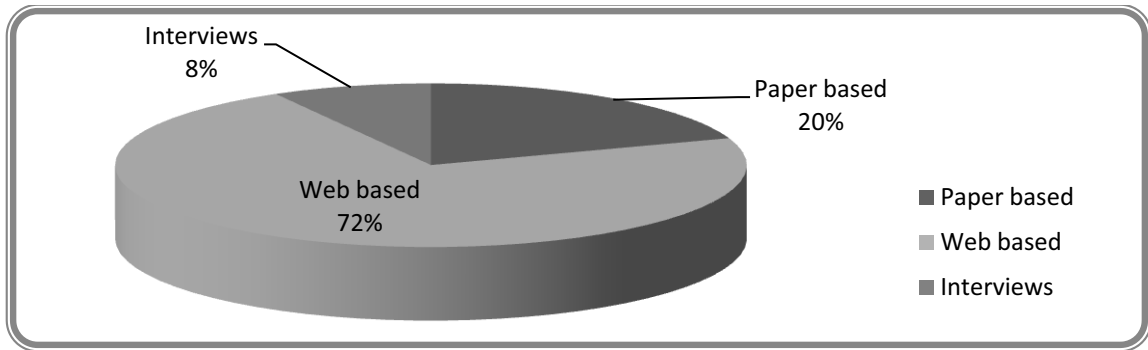


Figure 4.24: Q4: In the future, which method of interaction would you prefer for this kind of study?

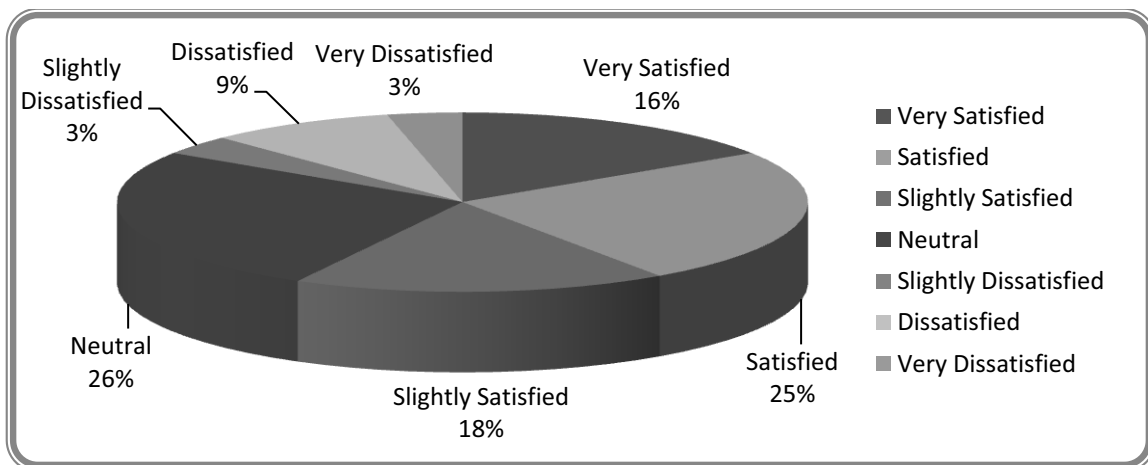


Figure 4.25: Q5: How satisfied would you feel if these questions were asked in a focus group of persons occupying adjacent workspaces as compared to this survey?

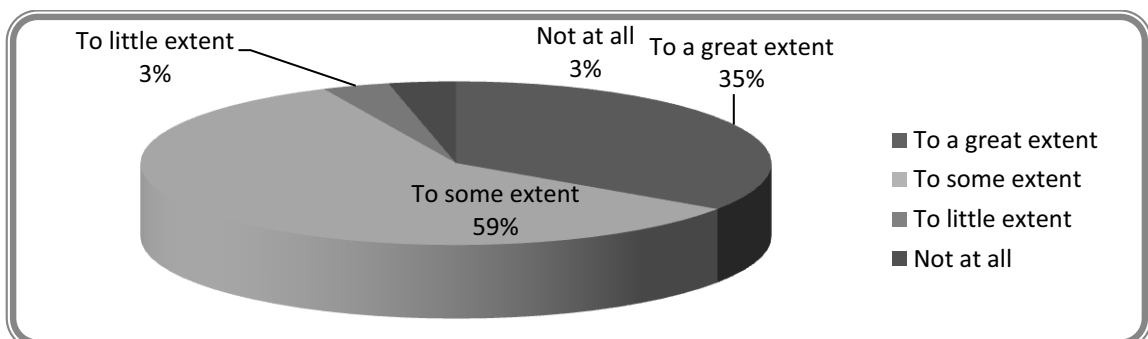


Figure 4.26: Q6- In your opinion, to what extent did the survey cover aspects that you would like to comment upon about your office?

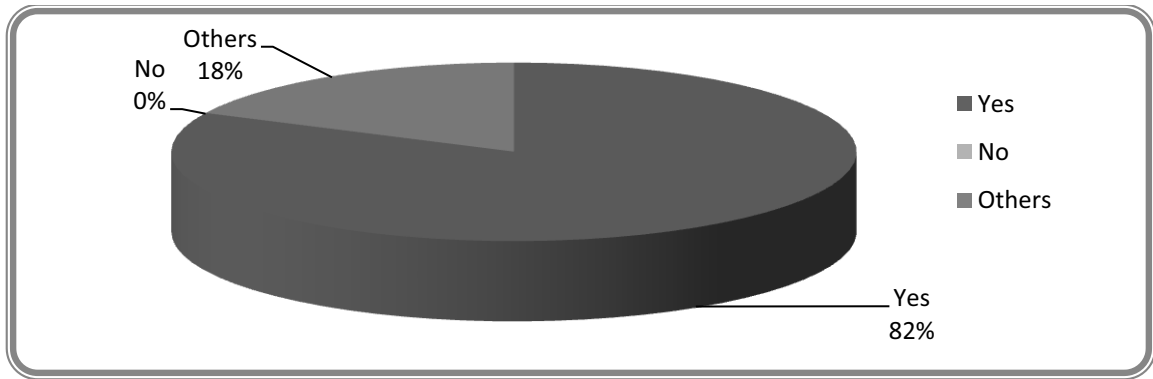


Figure 4.27: Q7- Do you consider that right questions are being asked of building occupants?

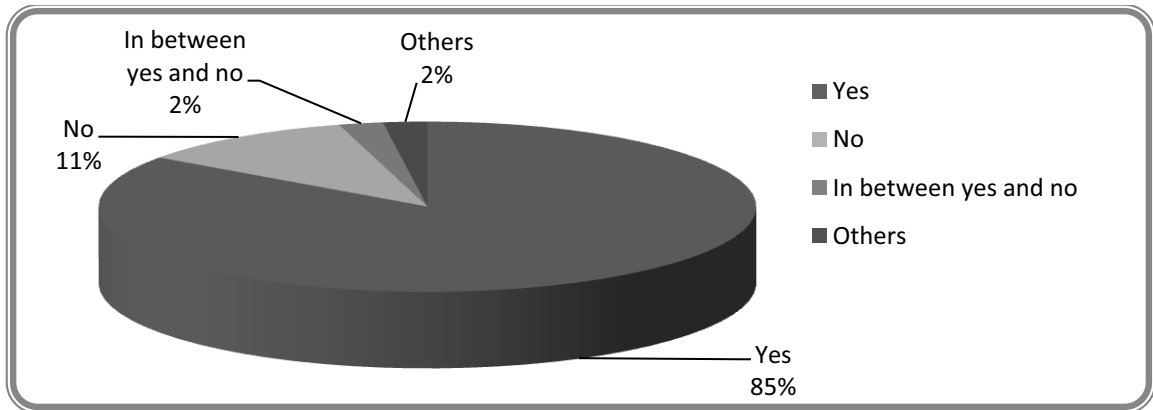


Figure 4.28: Occupant Perception: Does the survey allow you to effectively indicate your satisfaction with the design of your workspace?

4.3.2.5 Occupant Observations, Suggestions, and Recommendations

This section presents excerpts of open-ended responses from the survey feedback section to bring forth the observations, suggestions, and recommendations of the Spartan Way occupants:

- When asked if the right questions were being asked, an occupant stated, “Need additional questions on layout of units, accessibility to conference rooms, desk suitability, space issues, good use of current locations etc”.

- When asked if any aspects were not included that occupants consider important and which impact their satisfaction with their workspace, occupants stated, “Ladies restroom needs much attention - in terms of location, number of stall, odor, common areas, café lounge, ease and location of restroom facilities. Other comments were:
 - “Building security. Inability to feel safe in a cubicle environment during night and weekend work when building is mostly empty.”
 - “More regarding privacy (noise level in cubicle environment).”
 - “Restrooms, cleanliness, kitchen facilities and how it supports staff who bring lunches, lighting in common areas.”
 - “The building is new- it would cost a tremendous amount of money to implement changes for best comfort and work style of workers. If the office design changes are to be made, workers from all levels need to be included not just the leadership teams.”
- When asked if any questions were confusing or unclear, to some occupants it seemed that the same questions were being asked but in different use of verbiage, to another occupant it was difficult to figure out what was being asked in Q31. Other comments were as follows:
 - “Q28 should state- "If No, skip to Q7 which is on page 4, but not numbered. Q36- NA if not long-term employee of unit, likewise for Q38. Q56 needs likert scale. #58-60 also NA to employees new to the unit.”
 - “On Q58-61, not sure if you meant HVAC or computer technology.”

- “Questions refer to renovations- this was a new building. Q58-60- not sure what is meant by new technology.”

- Only one occupant stated, “This survey took longer than stated and I did not take any calls during this time.”

4.4 Comparative Analysis of Survey Feedback from S.P.D.C. and Spartan Way

In order to be able to compare the survey feedback responses from the S.P.D.C. and the Spartan Way, both excel worksheets were combined into a single one as shown in Figure 4.29 below:

Response	1	2	3	4	5	6	7	8	9	10	11	12
	Format	Appr	open-ended	Survey Method	Focus Group	Coverage Extent	Right Questions	If No, What Questions?	Effectiveness of Survey	Missing Aspects	Unclear & Confusing Questions	Necessary Questions
07181	6	5		2	2	3	3	too many questions require uniformed opinion	0	fourth floor		too many
47365	4	3	3	2	2	2	1		1		The scale generally starts from very dissatisfied to satisfied in the survey!	47 and 51 as same question
50895	2	2	3	3	1	1						
52302	1	1	3	1	4	2	1		1			
41620	2	1	3	2	2	1	1					
54346	1	1	3	1	3	1	1	1				
27071	1	3	3	2	3	2	1		1			
50626	1	1	3	1	1	1	1		1			
58324	4	4	3	2	5	2	1	1				
6776	3	3	3	2	3	3	1		1			
56574	2	2	3	2	3	1	1		1			
59576	2	3	1	2	1	1		process questions related to how they selected their space and work				
57660	3	2	4	2	1	1						
64212				2	2	2						
74489	3	3	1	2	3	2	0		0	Common areas, bathrooms		
50511	5	4		2		3		Space issues, good use of current locations etc.	in between yes and no	Ladies restroom needs much attention - in terms of location, number of stall, odor etc.		
89847	3	4	2	2	1	4		Not sure what overall objectives	1			
42186	2	2	3	1	2	1	1		1			
54120	6	4	2	1	4	3	1		1			
03328	2	2	3	2	2	2	1		1			
55979	3	2	1	2	2	2	1		1			
56735	2	2	3	2+3	1	1	1		1			
53051	3	2	3	1	2	1	1		1			
55667	1	1	3	2	4	2		Need additional questions. Layout of units, accessibility to	1	My only concern is temp. bathrooms on the second floor. During summer, it is very hot. No air is circulated at all. We do not have enough large conference rooms to use. We end up		

Figure 4.29: Snapshot of Worksheet with Combined Responses from the S.P.D.C. and Spartan Way

This new spreadsheet containing the S.P.D.C. and the Spartan Way Responses was used to determine the commonalities, differences, and uniqueness of responses from both buildings. The combined findings are summarized in Table 4.3, 4.4, and 4.5. Table 4.3 presents the mean and percentage of values for each response category from both buildings.

SECTION 4: POE SURVEY EVALUATION QUESTIONS	RESPONSE CATEGORIES	S.P.D.C.	SPARTAN WAY	MEAN
Q1. How satisfied are you with the format of the survey?	Very satisfied	26%	10%	18%
	Satisfied	30%	31%	30.5%
	Slightly satisfied	18%	21%	19.5%
	Neutral	19%	24%	21.5%
	Slightly dissatisfied	0%	5%	2.5%
	Dissatisfied	7%	7%	7%
	Very dissatisfied	0%	2%	1%
Q2. How satisfied are you with the appropriateness of the questions?	Very satisfied	26%	16%	21%
	Satisfied	29%	37%	33%
	Slightly satisfied	26%	19%	22.5%
	Neutral	15%	23%	19%
	Slightly dissatisfied	4%	2%	3%
	Dissatisfied	0%	3%	1.5%
	Very dissatisfied	0%	0%	0%
Q3. Please comment on the balance of open-ended vs. closed responses.	Need more open-ended	8%	18%	12%
	Need fewer open-ended	88%	4%	46%
	Just right for me	4%	78%	41%
Q4. In future, which method of interaction would you prefer for a similar study?	Web-based	57%	72%	64.5%
	Paper-based	36%	20%	28%
	Interviews	7%	8%	7.5%
	Any other? Please Specify.	0%	0%	0%

Table 4.3: Survey Feedback: Comparative Analysis of Response Summary

Table 4.3 Continued: Survey Feedback: Comparative Analysis of Response Summary

SECTION 4: POE SURVEY EVALUATION QUESTIONS	RESPONSE CATEGORIES	S.P.D.C.	SPARTAN WAY	MEAN
Q5. How Satisfied would you feel if these questions were being asked in a focus group of persons occupying adjacent area as compared to this survey?	Very satisfied	22%	16%	19%
	Satisfied	30%	25%	27.5%
	Slightly satisfied	26%	18%	22%
	Neutral	11%	26%	18.5%
	Slightly dissatisfied	4%	3%	3.5%
	Dissatisfied	7%	9%	8%
	Very dissatisfied	0%	3%	1.5%
SECTION 4: POE SURVEY EVALUATION QUESTIONS	RESPONSE CATEGORIES	S.P.D.C.	SPARTAN WAY	
Q6. To what extent did the survey cover the aspects you would like to comment on related to your office?	To a great extent	89%	35%	
	Some extent	11%	59%	
	To a little extent	0%	3%	
	Not at all	0%	3%	
Q7. Do you consider the right questions are being asked?	Yes	82%	82%	
	No	0%	0%	
	Other, please specify	18%	18%	
Q9. Do you think the survey allows you to effectively indicate your satisfaction with the design of your workspace?	Yes	67%	85%	
	No	5%	11%	
	In between yes and no	6%	2%	
	Other, please specify	22%	2%	

As seen in Table 4.3, the percentage of occupants responding to particular categories varies to some extent between the S.P.D.C. and the Spartan Way. For example, 88% of the S.P.D.C. occupants need fewer open ended whereas 78% of the Spartan Way occupants consider the number of open-ended questions just right. The majorities of occupants in both buildings are satisfied with the survey format, the appropriateness of questions, and have recommended the use of a web-based approach for future interaction.

When it comes to the extent to which the survey has covered aspects that occupants would like to comment on, only 35% of the Spartan Way occupants as compared to 89% in the S.P.D.C. choose the option, “to a great extent”. The reason for this difference can be explained on the basis of responses received from Spartan Way in the open-ended sections, as shown in Table 4.4, and, which is discussed earlier in section 4.3.2.3 C. It seems that satisfaction with common areas (restrooms, lunch room, conference room, etc) strongly contribute to their overall satisfaction with their workspace. However, for the question- *Do you think that the survey allows you to effectively indicate your satisfaction with the design of your workspace?* 67% in the S.P.D.C. and 85% in the Spartan Way said *yes*. This means in S.P.D.C., 89% of the occupants consider the survey covers aspects to a great extent, but 67% think that the survey allows them to effectively indicate satisfaction with the design of their workspace. In Spartan Way, 35% of the occupants consider the survey covers aspects to a great extent, but 85% think that the survey allows them to effectively indicate your satisfaction with the design of their workspace.

QUESTIONS	S.P.D.C.	SPARTAN WAY
Q8. (Follow up questions to Q7) If No, what questions should be asked?	<ol style="list-style-type: none"> 1. Ask about overall staffing concept 2. Social interaction questions 3. Ask us about teaching, studios & computer lab space 4. Consider flexibility of the space for use in future 5. Process questions related to how they selected their space and work 	<ol style="list-style-type: none"> 1. Space issues, good use of current locations etc 2. Need additional questions. Layout of units, accessibility to conference rooms 3. What we need? How we work best? What type of environment do we work best in? 4. Desk suitability
Option: Others-please specify for Q9. <i>Do you think the survey allows you to effectively indicate your satisfaction with the design of your workspace?</i>	<ol style="list-style-type: none"> 6. For IEQ purposes- yes. Use of common spaces, lunch room, etc. meeting rooms with students on each floor 	<ol style="list-style-type: none"> 5. Ladies restroom needs much attention - in terms of location, number of stall, odor etc. 6. Access to building (from parking lot #79) 7. This survey took longer than stated and I did not take any calls during this time.
Q10. Please mention any aspects that may not have been included for evaluation of your satisfaction but which may be representative of performance of your workspace function and environment in your opinion.	<ol style="list-style-type: none"> 7. Space satisfaction is closely related to overall management and job duties- more questions about this. 8. More regarding privacy (noise level in cubicle environment) 9. Sufficiency of study areas 	<ol style="list-style-type: none"> 8. Sufficiency and location of common areas such as lunch rooms, cafeterias, meeting rooms, rest rooms 9. Access to building from parking 10. Cleanliness 11. Building Security

Table 4.4: Survey Feedback Section: Suggestions for Functional and Indoor Environment Aspects and Questions to be included in Evaluation (Verbatim)

Table 4.4 presents the functional and indoor environmental aspects and related questions suggested by building occupants. Table 4.5 presents the questions that both building occupants find unclear, confusing, and/or unnecessary. Based on this, the POE questions were refined in the final survey presented in Chapter 5.

QUESTIONS	S.P.D.C.	SPARTAN WAY
Q11. Please list by number the questions that you find unclear or confusing and explain why?	<ol style="list-style-type: none"> 1. The use of the phrase "satisfaction" is vague to me. It does not capture my feelings- although there is plenty of opportunity- to relate concern in the open ended portion 2. The scale generally starts from very dissatisfied to satisfied in a survey 3. Need NA option 4. Q51-53, Q24-25, Q59-62 5. Q 58-61, not sure if you meant HVAC or computer technology. 	<ol style="list-style-type: none"> 1. Q31 I couldn't quite figure out what you were asking 2. After Q31 and Q32, the italicized text doesn't tell you what to do if you have no previous office space 3. Q28 should state- "if No, skip to Q31 which is on page 4, 4. Q36- NA if not long-term employee of unit, likewise for Q38. 5. Q57 needs likert scale 6. Q59-Q62 also NA to employees new to the unit 7. Questions refer to renovations- this was a new building. 8. Q58-60- not sure what is meant by new technology.
Q12. Please list by number any questions that you feel were unnecessary?	<ol style="list-style-type: none"> 6. Age 7. Q48 and Q52 same question- ventilation 	<ol style="list-style-type: none"> 9. It seems that the same questions were asked but in different uses of verbiage

Table 4.5: Survey Feedback: Comments on Unclear, Confusing, and Unnecessary Questions (Verbatim)

4.5 Conclusions

The information extracted and summarized in the above tables has been used to make changes to the POE survey and create the modified version which is discussed in Chapter 5.

4.6 Chapter Summary

This chapter presented the data collected and analyzed to accomplish the goal and objectives of this research study. The following chapter will discuss the changes made to the POE survey based on findings from its application in the case study facilities/ (analysis of the survey feedback responses from the S.P.D.C. and the Spartan Way) and also present the final POE survey.

CHAPTER 5

POST OCCUPANCY EVALUATION SURVEY

5.1. Chapter Overview

This chapter presents a discussion of the changes made to the trial POE survey followed by the modified final POE survey. These changes were based on findings from the performance evaluation of the case study facilities and the analysis of survey feedback responses from Stadium and Spartan Way occupants. The trial POE survey was constructed based on the information obtained from literature review and administrator interviews.

First, the changes flowing from the open-ended responses are presented as a part of the researcher's observation and analysis in Tables 5.1a-b and 5.2a-b. Next, the direct recommendations are quoted from the open ended sections and the changes flowing from those are discussed in Tables 5.4 and 5.5.

5.2. Researcher's Observation:

This section presents the researcher's observation with regard to the occupants' responses to the open-ended questions in the tested POE survey. Considering questions from one to seven that cover personal workspace layout, workspace location, and the amount of space available for work and storage; respondents have stated reasons for their satisfaction or dissatisfaction interchangeably as shown in Tables 5.1a and 5.1b. Therefore, the three separate paired questions on each of these aspects have been replaced

by a single pair of questions to inquire about all three aspects collectively in the revised POE survey. The modified pair of questions is as follows:

- ❖ *How satisfied are you with your personal workspace layout, workspace location and the amount of space available to you for work and storage?*
- ❖ *If you are satisfied or dissatisfied, please explain why.*

SCHOOL OF PLANNING DESIGN AND CONSTRUCTION RESPONSES		
OFFICE LAYOUT (Q2)	WORKSPACE LOCATION (Q4)	AMOUNT OF SPACE (Q8)
More work space needed.		
Faculty rooms are all over the place and difficult to find.	NA	Need additional 100 SF for my office.
	No place to move really- but better shades to protect from the sun.	
Removed from faculty with whom I have most contact- organize faculty by major.	Same as Question 2	Need more closed general storage. We lack storage for hard copies- student portfolios, etc.
More storage space. Computer screen not facing the door.		More storage for students' drawings and projects.
It's a bit small- 50% bigger would be convenient	Overall everything's is everywhere. Grad student's office all the way upstairs. Main office downstairs. A more controlled layout in the overall has been better for communication purposes. Also all CM profs are all over in the buildings. Can't get to see them often if not personally aiming it. Low interaction due to layout.	See Question 2
Bigger, more workable area	Not sure, but feel the overall space for workers not designed to the best use of the space.	

Table 5.1a: SPDC Responses to Questions 1 - 8 (Verbatim)

SPARTAN WAY RESPONSES		
OFFICE LAYOUT (Q2)	WORKSPACE LOCATION (Q4)	AMOUNT OF SPACE (Q8)
Design to allow complete departments to reside alongside each other within talking or seeing distance. More occupied offices. Chat rooms wasted valuable space.	Remain fairly neutral on location. Has been removed from main office areas, but that is okay at times, as the cubicle layout, noise, and disturbance make it hard to concentrate to write or have phone conversations.	
More privacy. Sound travels very easily through our work area and it is different to conduct confidential business when everyone around can hear.	Too far from copy machine and supplies too. Far from main reception area.	
Needed to be contiguous with colleagues with whom I frequently interact.	I would not locate offices in a dark corner	
The curve desk area makes it hard to use keyboard- need straight area for this (like office desks). Not enough space to back up in chair (run into back desk). Must keep both front plus back desk at some height to use keyboard (defeats purpose). Cannot see co-workers from my space.		
Adequate arrangement seems like no real creative design effort expended. With some consultations the workspace could be more inspired, interesting. Look a bit more like university rather than institution. I would like to see the university being forward thinking- making staircases a center piece for first 2 floors as a option for fitness. The building is nice but unimaginative.		

Table 5.1b: Spartan Way Responses to Questions 1 - 8 (Verbatim)

**Table 5.1b Continued: Spartan Way Responses to Questions 1 - 8
(Verbatim)**

SPARTAN WAY RESPONSES		
OFFICE LAYOUT (Q2)	WORKSPACE LOCATION (Q4)	AMOUNT OF SPACE (Q8)
Put a door on my cubicle. Put helpdesk behind a closed door. So disruptive. Reconfigure area and build offices for system group.		Need more space. I'm a techie and need to work on 3-4 personal computers at a time to setup in my area.
Cubicles are too close together, you can hear everything going on in other cubicles sometimes making it hard to focus.		Need more storage space (drawers and bigger desk area to spread work out).
		Our storage room isn't big enough- very crowded. We store the shredder bin- which everyone uses. We also store all of the toners for all the printers/copiers including photocopy. All centrally placed printers, also kitchen supplies and share with 2 other units.
I get bored and would like the ability to rearrange the desk and other office furniture. The colors are drab and don't keep you motivated.	I think the cubicles are too small and awkward. Make our cubicles a little bigger and put more space between the cubicle groups or just give me an office.	Workspace functions well for job responsibilities but not to conduct business conversations. A little more space/ bigger storage cabinet would be nice.
Out of the way of noise+ passer bys.	Huge offices vs. tiny cubicles	Room to lock up secure documents
Need more space for storage, within office space. I have kind of high jacked rolling file cabinets from unoccupied work stations.		

**Table 5.1b Continued: Spartan Way Responses to Questions 1 - 8
(Verbatim)**

SPARTAN WAY RESPONSES		
OFFICE LAYOUT (Q2)	WORKSPACE LOCATION (Q4)	AMOUNT OF SPACE (Q8)
I think such a narrow design is not conducive to efficient work or to fostering a collegial atmosphere. A copier/ printer is located at each end if you walk to one & if it's being used it's about the length of a football field to go to the other one. You hardly ever see people who are housed at the ends of the offices.	Actually, I guess I am quite fortunate to be near the middle of the long office. Close to the bathroom & mailroom & office entrance. On the other hand, there quite a lot of traffic because my cubicle is between most popular conference room and the bathrooms.	I would very much appreciate more surface area& more drawer space. I have a lot of paper and a lot of things going on at one once. So my cube always looks like a disaster area.
We do not have enough space so that everyone on our team/ unit is all together. Cubes spaced apart in different areas of building.		
Size of office is good but it is in a high traffic noisy area that requires door to be closed in order to focus on work. Co-workers may think I am anti social but not so. Windows clear in door would help.	Quieter location with assistant in adjoining but private office- but stadium tower does not appear to give CT's private offices. Ideal which we had previously.	

Similarly, considering questions from 18 to 23 that cover office furniture, furnishing, and equipment; respondents have stated reasons for their satisfaction or dissatisfaction interchangeably as shown in Tables 5.2a and 5.2b. Therefore, the three separate paired questions on each of these aspects have been replaced by a single pair of

questions to inquire about all three aspects collectively in the revised POE survey. The modified pair of questions is as follows:

- ❖ *How satisfied are you with your personal workspace furniture, furnishing, and equipment?*
- ❖ *If you are highly satisfied or dissatisfied, please explain why.*

SCHOOL OF PLANNING DESIGN AND CONSTRUCTION RESPONSES		
OFFICE FURNITURE (Q19)	OFFICE FURNISHING (Q21)	OFFICE EQUIPMENT (Q23)
Ugly	I brought my own carpet and office furniture	no place for models and drawings; the office is like a rat in a small cage.
Furniture is very light duty. It does not seem durable for long haul.	See #19 for furniture.	
furniture is heavy and low quality, hard to move		
Old furniture	Blinds are outdated and dusty	
Rocks, sticks, difficult to move, small drawer, only open certain drawers if others are closed		
	The finish could have been better.	

Table 5.2a: SPDC Responses to Questions 18 - 23 (Verbatim)

SPARTAN WAY RESPONSES		
OFFICE FURNITURE (Q19)	OFFICE FURNISHING (Q21)	OFFICE EQUIPMENT (Q23)
	I don't like the carpet because it doesn't have any padding. It is hard on the feet.	The printer is always jamming and breaking down.
It works; it's just ugly-make a better color selection.	Change color scheme.	I would make the temperature higher but this is something that no one will ever be happy with someone is always cold someone else hot.

Table 5.2b: Spartan Way Responses to Questions 18 - 23 (Verbatim)

**Table 5.2b continued: Spartan Way Responses to Questions 18 - 23
(Verbatim)**

SPARTAN WAY RESPONSES		
OFFICE FURNITURE (Q19)	OFFICE FURNISHING (Q21)	OFFICE EQUIPMENT (Q23)
	Chairs do not roll without major effort because of bumpy patterned carpet. Colors are drab and patterns are ridiculous. Work surface corners are sharp or edged with hand rounded pieces not good for computer use.	
	Put padding under carpet; pick a smoother carpet that vacuum easily.	Too far to go to make a copy and took a year but finally got us a printer in our area.
		I wish we had personal printers in our offices.
Brought our own furniture over from the Kellogg center. I picked it out it works well, was brought over from Kellogg center.	Could use carpet cleaning overall & stain removal.	Need a higher quality printer, Need upgraded computer- grinding noise, have been told by IT that my computer is dying- might crash.
		Our printers commonly have problems and the other printer that we can use is all the way down on the south end of the building.
Keyboards should be in ledges that are height adjustable.	I think way too much money was spent on the décor of our office, considering this is an university. Why do we need sculpted carpets or marble topped conference tables, those ridiculous round things on the top of the cabinets? When we moved in here, there was such a sense of office being way more important than the people in it. Plus the design of the bathroom sink area is horrible. There's standing water on the counter constantly- sometimes so bad, it is dripping on the floor.	I very much appreciated my computer double screens. I really dislike the printer copiers. I have to frequently make a small set of copies and often have to wait for print jobs coming through as a copy did the one dedicated to the copier.

5.3. Respondent's (Direct) Recommendations

This section presents the changes made to the tested POE survey based on the responses (recommendations) in the survey feedback section. As shown earlier in Table

4.4, there are additional evaluation factors suggested by respondents. Table 5.3 shows those evaluation factors and questions suggested, if they were accepted or rejected, reason for their acceptance or rejection, and the action taken. Mostly POE factors and questions were rejected if they were out of the research scope or beyond the study goal and objectives. The recommended aspects mentioned in Table 5.3 are derived from Tables 4.4 and the recommended questions mentioned in Table 5.4 are derived from Tables 4.5.

RECOMMENDED ASPECTS FROM SPDC AND SPARTAN WAY (TABLE 4.4)	ACCEPTED/ REJECTED	REASON	ACTION TAKEN
SPDC comment no.1 Overall staffing concept	Rejected	Beyond current study goal and objectives.	No action taken
SPDC comment no.2 Social interaction	Rejected	This aspect has already been included in questions 11 and 12.	No action taken
SPDC comment no.3 Teaching spaces, study areas, studios and computer lab spaces	Partially accepted	A part of research goal and objectives. Out of research scope. Will be considered in follow-up projects.	No action taken within the current study
SPDC comment no.4 Flexibility of space for use in future	Accepted	Within research scope and could be considered as a part of the study goal and objectives.	Included in the POE questionnaire
SPDC comment no.5 Method of selection of workspace	Accepted	Within research scope and could be considered as a part of the study goal and objectives.	Included in the POE questionnaire

Table 5.3: Reasons for Accepting or Rejecting Recommended Aspects and Actions Taken Towards POE Survey

Table 5.3 continued: Reasons for Accepting or Rejecting Recommended Aspects and Actions Taken Towards POE Survey

RECOMMENDED ASPECTS FROM SPDC AND SPARTAN WAY (TABLE 4.4)	ACCEPTED/ REJECTED	REASON	ACTION TAKEN
SPDC comment no.6 Performance of common areas (lunch rooms, restrooms, conference rooms)	Partially accepted	A part of research goal and objectives. Out of research scope. Will be considered in follow-up projects.	Will be considered in follow up projects
SPDC comment no.7 Overall management and job duties	Rejected	Beyond current study goal and objectives.	No action taken
SPDC comment no.8 Privacy in cubicle environment	Rejected	Within research scope and would be considered a part of the study goal and objectives.	Privacy is already included in the POE questionnaire
Spartan Way comment no.9 Access to building from parking	Partially accepted	A part of research goal and objectives but, out of research scope. Will be considered in follow-up projects.	Will be considered in follow up studies

RECOMMENDED QUESTIONS FROM SPDC AND SPARTAN WAY (TABLE 4.5)	ACCEPTED/ REJECTED	REASON	ACTION TAKEN
Table 4.5: Comment 1 from SPDC <i>The use of the phrase "satisfaction" is vague to me. It does not capture my feelings- although there is plenty of opportunity- to relate concern in the open ended portion.</i>	Rejected	The primary purpose of the POE survey is to assess overall satisfaction and therefore the use of the phrase "satisfaction"	No Action Taken

Table 5.4: Reasons for Accepting or Rejecting Recommended Questions and Actions Taken Towards POE Survey

Table 5.4 continued: Reasons for Accepting or Rejecting Recommended Questions and Actions Taken Towards POE Survey

RECOMMENDED QUESTIONS FROM SPDC AND SPARTAN WAY (TABLE 4.5)	ACCEPTED / REJECTED	REASON	ACTION TAKEN
Table 4.5: Comment 2 from SPDC <i>The scale generally starts from very dissatisfied to satisfied in a survey</i>	Accepted	Recommended by MSU's Statistics Consultants	Response options reversed in revised POE survey
Table 4.5: Comment 3 from SPDC <i>Need NA option</i>	Accepted	This option when added gives more flexibility to respondents.	Not applicable option added to all "yes-no" questions in the POE questionnaire
Table 4.5: Comment 4 from SPDC <i>Q24-25, Q51-53, Q59-62</i>	Rejected	Outlier response.	No Action Taken
Table 4.5: Comment 5 from SPDC <i>Q 58-61, not sure if you meant HVAC or computer technology.</i>	Partially Accepted	Instruction could be more specific	Questions 56 through 60 modified for clarity
Table 4.5: Comment 1 from Spartan Way <i>Q31 I couldn't quite figure out what you were asking</i>	Accepted	Instruction could be more specific	Question modified for clarity
Table 4.5: Comment 2 from Spartan Way <i>After Q31 and Q32, the italicized text doesn't tell you what to do if you have no previous office space</i>	Accepted	Instruction could be more specific	Question modified for clarity
Table 4.5: Comment 3 from Spartan Way- <i>Q28 should state- "if No, skip to Q31 which is on page 4"</i>	Accepted	Instruction could be more specific	Question modified for clarity
Table 4.5: Comment 4 from Spartan Way <i>Q36- NA if not long-term employee of unit, likewise for Q38.</i>	Accepted	Instruction could be more specific	Question modified for clarity

Table 5.4 Continued: Reasons for Accepting or Rejecting Recommended Questions and Actions Taken Towards POE Survey

RECOMMENDED QUESTIONS FROM SPDC AND SPARTAN WAY (TABLE 4.5)	ACCEPTED / REJECTED	REASON	ACTION TAKEN
Table 4.5: Comment 5 from Spartan Way <i>Q57 needs likert scale</i>	Accepted	Instruction could be more specific	Question modified for clarity
Table 4.5: Comment 6 from Spartan Way <i>Q59-Q62 also NA to employees new to the unit</i>	Accepted	Instruction could be more specific	Question modified for clarity
Table 4.5: Comment 7 from Spartan Way <i>Questions refer to renovations- this was a new building.</i>	Partially Accepted	Limitations in building selection	Not Applicable
Table 4.5: Comment 8 from Spartan Way <i>Q58-60- not sure what is meant by new technology.</i>	Partially Accepted	Instruction could be more specific	Question modified for clarity

UNECESSARY/CONFUSING QUESTIONS	ACCEPTED/ REJECTED	REASON	ACTION TAKEN
Table 4.5: Comment 6 from SPDC- Age	Rejected	Outlier response	No Action Taken
Table 4.5: Comment 7 from SPDC- Q48 and Q52 same question- ventilation	Partially accepted	Question seems repetitive	Removed from thermal comfort category and retained under air quality.
Table 4.5: Comment 9 from Spartan Way- It seems that the same questions were asked but in different uses of verbiage	Rejected	No particular questions referred in response	No Action Taken

Table 5.5: Reasons for Accepting or Rejecting Comments for Unnecessary/Confusing Questions and Actions Taken

5.4. Modified POE Survey Questions

Based on the recommendations from the Spartan Way and the SPDC occupants, the following changes were made to the POE survey:

1. The likert scale was reversed from “very dissatisfied” to “very satisfied” in all questions inquiring about occupants’ satisfaction level.
2. The evaluation factors, “flexibility of space for use in future” and “selection of workspace” were added to the first section of the POE survey.
3. Questions inquiring about occupants’ satisfaction level with regard to new technologies implemented in the case study facilities were rephrased for clarity.
4. The question inquiring about occupants’ satisfaction with “ventilation of their workspace” was previously mentioned in two sections, “thermal comfort” and “air quality”. This question was deleted from the “thermal comfort” section to avoid repetition.
5. A “not applicable” option was added to all the “yes-no” questions based on recommendation of statistics consultant at Michigan State University.
6. In the last section of the POE survey, the question inquiring about opinion of respondents with regard to focus groups versus survey was modified. The likert scale format was replaced with a multiple choice format.
7. The final and most significant modification made to the survey was to convert it from a paper-based to a web-based format. This was based on the analysis results that 57% of the SPDC and 72% of the Spartan Way occupants would prefer a web-based survey in the future as a method of interaction for this kind of study.

5.5. Conclusion

The modifications made to the POE survey were to enhance the simplicity and efficiency of the overall questionnaire and to make it more user-friendly. The POE survey from this study was not entirely but partly different from those already available in the literature in the following way: it is a stand-alone survey, focuses on evaluation of indoor environmental and functional performance, unlike the AUDE 2006 survey, that additionally investigates the technical performance of facilities and the overall performance of project in the design and construction phases, using a set of questionnaires; or unlike CBE, where, the questionnaire mainly investigates indoor environment. The most unique feature of this survey is that it allows university administrators to capture individual occupants' perception of their personal work space performance, of the related issues, and of what changes could be made to make the space more efficient and satisfactory for them. This automatically gives a direction for corrective action in future, which takes care of occupants' opinions.

5.6. Chapter Summary

This chapter discussed changes made to the POE survey based on findings from its application in the case study facilities (analysis of the survey feedback responses from Stadium and Spartan Way). The modified final POE survey is included in appendix B7. The next chapter presents the recommended POE process, which is the second main deliverable of this study.

CHAPTER 6

POST OCCUPANCY EVALUATION PROCESS

6.1 Chapter Overview

This chapter presents the recommended POE process that was developed based on the lessons learned from the application of a POE in this study, the information found in the literature from a comparison of the POE phases identified in the Key and Wener's 1980 study (Figure 2.5), the POE process models developed by Preiser in 2002 (Figure 2.7) and AUDE in 2006 (Figure 2.9), and the post implementation review process by New South Wales Treasury in 2004 (Figure 2.8).

6.2 Post Occupancy Evaluation Process

The recommended POE process as shown in Figure 6.1 comprises of four phases, namely, project establishment phase, data collection and analysis phase, reporting phase, and university phase for incorporation and corrective action. These four phases further comprise of various intermediate steps.

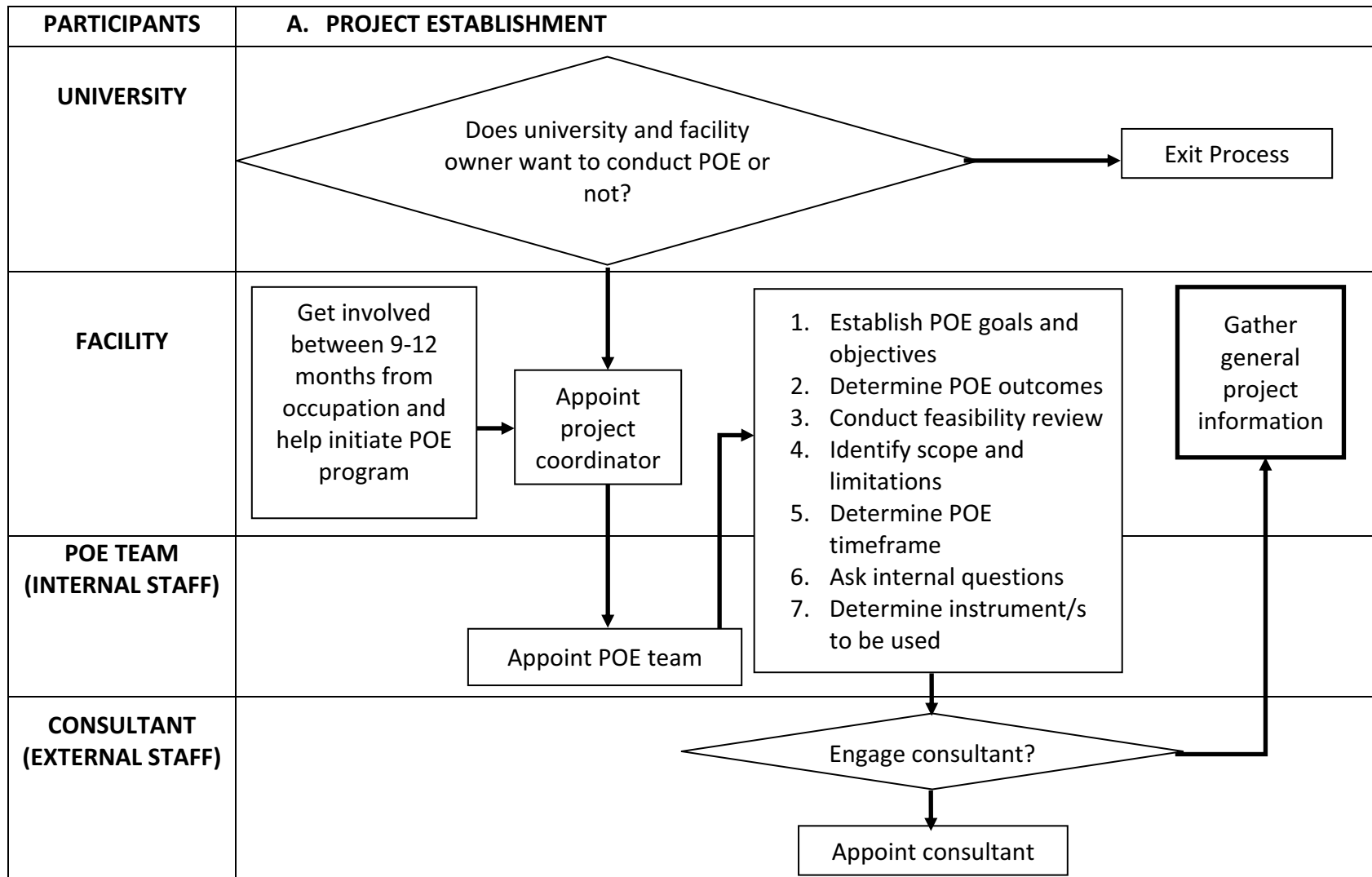


Figure 6.1 Post Occupancy Evaluation Process

Figure 6.1 Continued Post Occupancy Evaluation

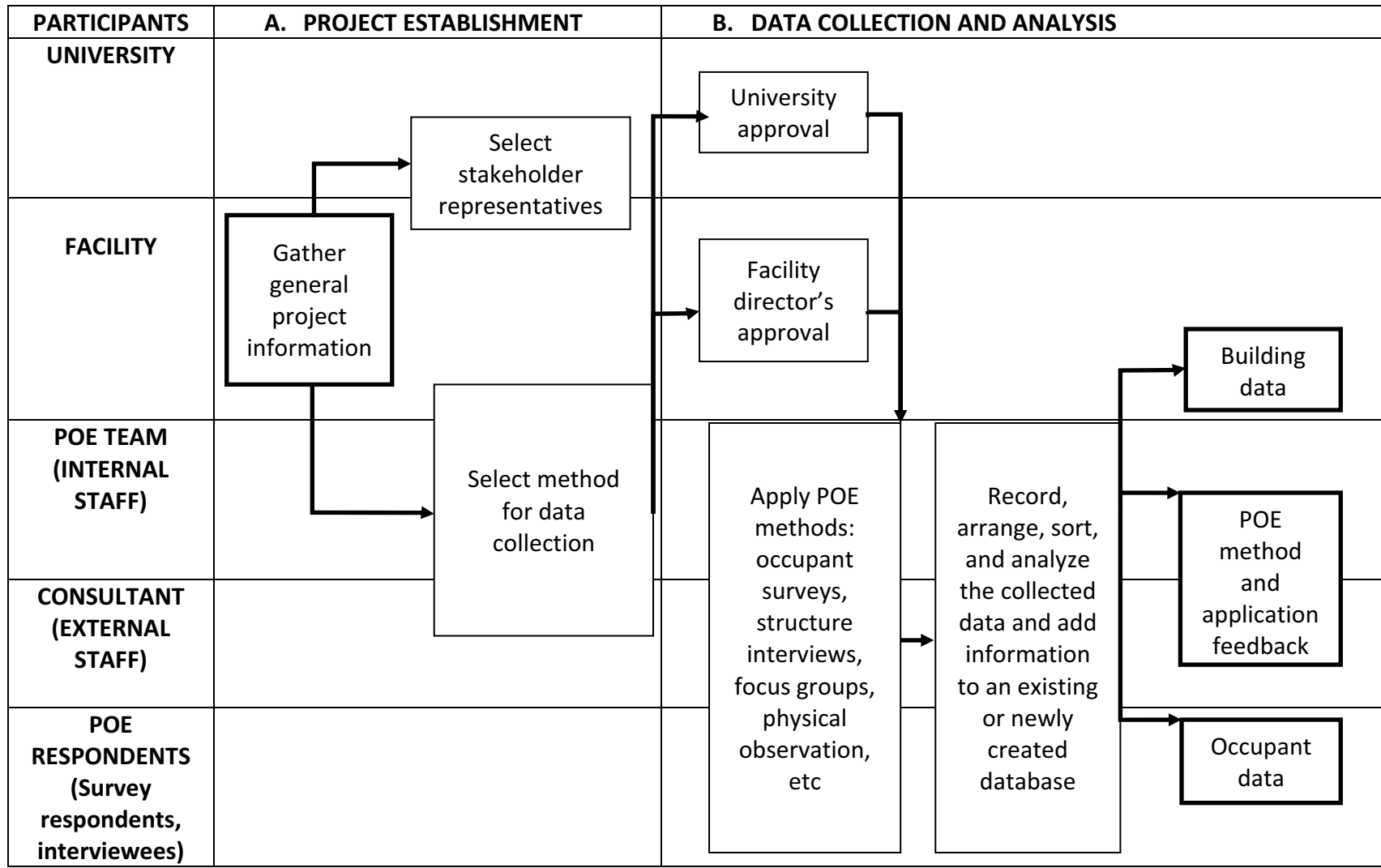
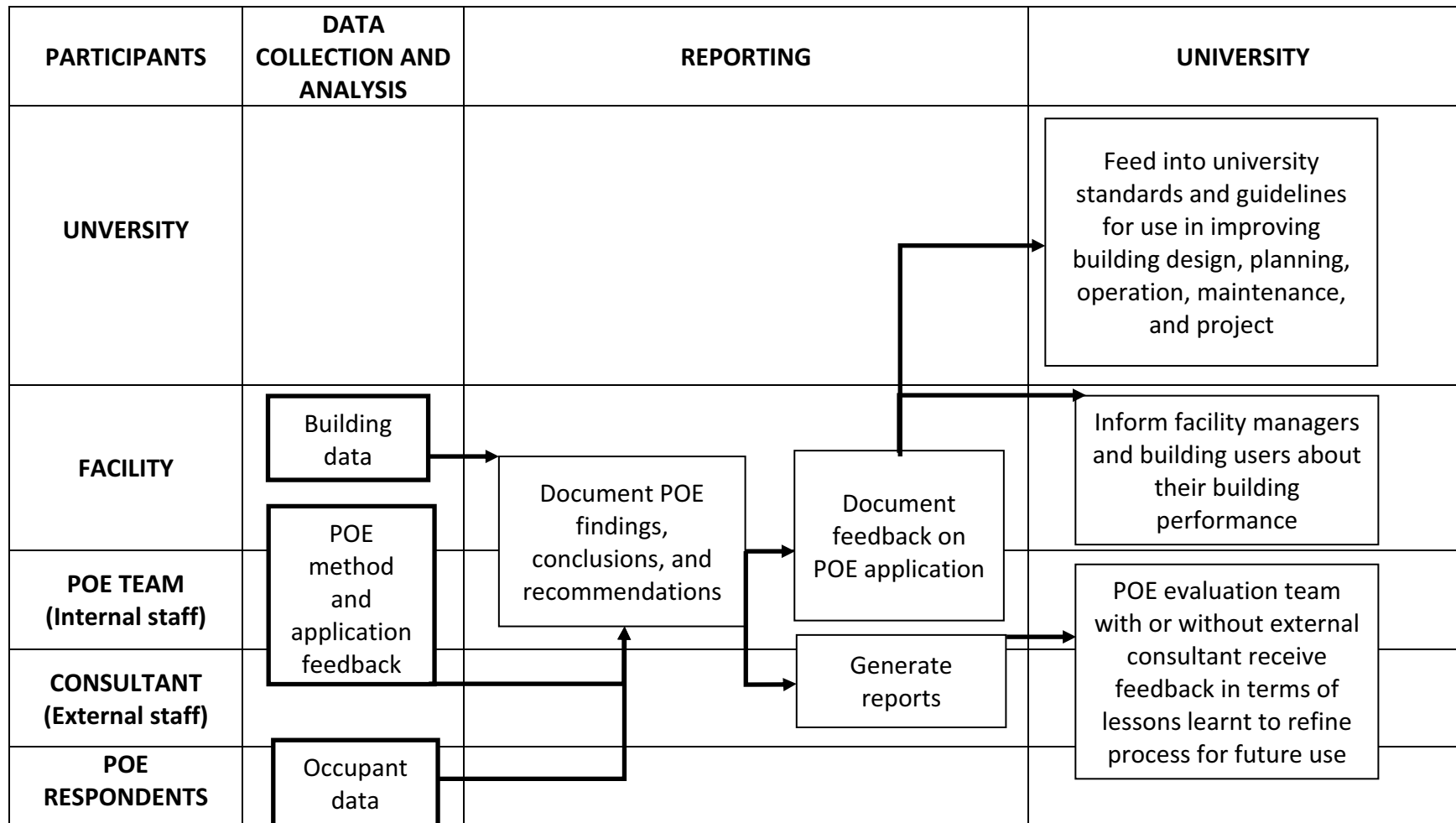


Figure 6.1 Continued Post Occupancy Evaluation



This recommended POE process involves four departments within the university:

1. The University administration (finance and planning departments especially)
2. Facility-to-be evaluated administration
3. Appointed POE team
4. Building occupants/ POE participants/respondents.

Additionally, an external POE expert/consultant may be employed if required. Detailed description of the four POE phases (project establishment, data collection and analysis, reporting, and university corrective action) are presented below:

6.2.1 Project Establishment Phase

In this phase of the recommended POE process, the project is to be established in terms of the POE method (data collection tool to be used) to be followed, the timeline to be considered, the goals and objectives to be accomplished, the outcomes to be attained, and the budget allocated. All of this is decided after a careful feasibility review and an identification of the overall POE scope, limitations, and the internal issues/questions/expectations. The information thus outlined is fundamental towards the rest of the phases of the process. All methods, tools, and strategies are to be based on the project plan established from now on.

The first step is for the university administrators to decide if they want to conduct a POE for a particular facility. The findings of this study indicate that this decision should be preferably taken between nine to twelve months from when the renovated or constructed facility has been occupied. This gives sufficient time for the occupants to have experienced the building's indoor environment and functional performance through

most of summer and winter to and from a more accurate/reliable/consistent opinion about the building's performance. At this point the facility manager/personnel should be included to appoint an internal POE project officer who participates with university administrators to appoint the POE team consisting of designers, consultants, planners, facility personnel, contractors, and occupants. This contributes to a holistic feasibility review which contributes to a reliable project plan. Once the internal team has reviewed all the details with regard to project establishment, the need for an external consultant is investigated. From this point on, if an external consultant is appointed, he or she can take responsibility for the entire POE process or work with internal personnel to choose methods to conduct the POE, or follow this method and report results to university administrators. If the external consultant is not required then the internal team takes responsibility for the following steps through the next phases. Once the POE team and the POE objectives are established, general project information is gathered, which is helpful in the analysis and reporting phase. At this point stakeholder representatives are selected and contacted. Next, the POE method for data collection is decided.

6.2.2 Data Collection and Analysis Phase

In this phase, the first step would be to get approval from university and facility administrators for the chosen POE method. Next, the POE is executed and relevant data is collected, recorded, sorted, and analyzed. In this phase the data collected using the approved POE method is categorized to serve the objective and purpose of the POE.

For example, in this study the data is collected using interviews and surveys, recorded in excel spreadsheets in numeric and open ended form, and analyzed using

descriptive statistic methods under the categories: building data, occupant data, and feedback data. The interviews were conducted among university administrators to obtain their insight on POE and to understand their expectations from POE. The surveys were conducted among building occupants to capture their perceptions towards their facility's functional and indoor environment performance, how it affects their satisfaction levels, and to obtain feedback on the distributed survey. The objectives of this study are: to develop a POE survey questionnaire for use by building occupants, to establish a POE process for universities, and to determine occupants' perceptions about building performance and their related satisfaction levels.

According to the literature reviewed for this study, POE data can be collected using walkthroughs and physical observation, structured interviews, surveys, focus groups, maintenance record review, energy assessment, etc. Table 2.3, Table 2.4, and Table 2.5 in Chapter Two presents a summary of the kinds of POE instruments that have been used, their advantages and disadvantages, their foci, and their preferred time of application. Based on the type of data collection instrument selected, data may be recorded and analyzed qualitatively or quantitatively.

6.2.3 Reporting Phase

In this phase, the findings of the data analysis are reported to the university and facility administrators. The findings may be presented in two categories: building performance and POE feedback. The building performance information can be further presented in sub-categories such as project performance, functional performance, indoor environment quality, technical performance, and energy performance with regard to

different groups and area types. It mainly flows from the ways in which the data is recorded, arranged/sorted and analyzed. The method and categories of reporting sets very strong grounds for the direction and extent to which the corrective actions are suggested in the next phase. The purpose of the POE feedback usually is to improve and streamline the evaluation process. The reporting formats will depend on the objective of the POE and the people to whom the findings are to be reported. For example, in this research study, the findings of the building performance have been presented in the form of a histogram.

6.2.4 University Standards and Corrective Action Phase

This is the phase where corrective actions may be taken against the problems reported. Additionally, the building performance and the feedback information are used to feed into the university standards database for improvement in design, construction and operation. Depending on the objective and nature of the information gathered with the help of the POE, it may contribute to the improvement or refinement of the technical standards, the project management standards, the design standards, the construction standards or it may just add to the building records, construction history, maintenance history, etc.

6.3 POE Process Limitations

The recommended POE process is generic and emphasizes the application of standard POE instruments in universities. The development of customized POE instruments is beyond the scope of this process. The process presents an overview of the

entire evaluation and does not elaborate individual phases as because, it will vary with other building types. The process may also need modification and elaboration of particular steps depending on the data collection instrument and the method of analysis used. The parameters of the feasibility review may vary depending on the purpose and the desired outcome of the POE. Since the POE process is generic, it does not present any categories for building performance or feedback data.

6.4 Conclusions

The POE process discussed in this chapter is intended to assist/guide facility managers or university administrators in creating their own process based on the purpose and desired outcome of the POE. This process caters to the first level of POE which is indicative of the buildings' performance. In order to further investigate or provide diagnosis of the buildings' performance or problems, the process may be made more intense in the appointment of a POE team, process feasibility review, application of POE instrument (data collection), and reporting of findings.

6.5 Chapter Summary

This chapter presented a discussion of the recommended POE process and its limitations. The following chapter presents the lessons learned from this study, the recommendations for POEs in universities, and the conclusions from this study.

CHAPTER 7

SUMMARY AND CONCLUSIONS

7.1 Chapter Overview

This chapter provides a discussion of the overall research scope, the accomplished research goal and objectives, research conclusions, the limitations experienced in this study, and also provides for a direction for future research. The following section presents an overview of the research project narrated through the chapters 1 to 6.

7.2 Research Overview

This research developed a process for universities to conduct post occupancy evaluation for renovated facilities with a focus on functional performance and indoor environment quality. This study also developed a survey questionnaire specific to office settings at universities. This was accomplished with the help of interviews and feedback surveys, which was intended to capture the perception of university providers and users. The method adopted for these deliverables was also intended to set an example for universities to be able to generate survey questionnaires specific to different settings within universities such as classrooms, common indoor , and outdoor spaces, research laboratories, computer laboratories, parking ramps etc.

Chapter 1 presented the need and significance of this study, how it will assist university organizations to identify and improve the elements of the physical work environment that will further enhance the work experience of faculty and staff, thereby generating higher satisfaction and productivity levels. This is followed by a discussion of

the overall research goal and objectives based on the research scope, limitations and the deliverables. Though the kind of setting used in this study is staff and faculty spaces in university office environments, it is not restricted to it and may also be used for other kinds of office settings within universities as well.

Chapter 2 presented a discussion of the literature reviewed for this study in order to identify the post occupancy evaluation factors to assess functional and indoor environment performance of office settings in universities. Additionally, the basics of POE were discussed, and studies similar in scope were identified in past research to compare existing POE methods and instruments.

Chapter 3 presented a detailed explanation of the methodology followed for establishment of the research project, identification of the functional and indoor environmental aspects and POE instruments, execution of interviews, development, and implementation of surveys, data analysis, and finally the development of the final POE survey, and documenting findings.

Chapter 4 presented the most salient part of this research which includes detailed explanation of all phases of data collection and analysis to accomplish the research goal and objectives.

Chapter 5 presented the overview and details with regard to development of the final web-based POE survey. This chapter discussed each section of the survey in detail and provided the rationale for the question content.

Based on the literature reviewed, methodology followed, data collected and analyzed during the study, this last chapter draws conclusions and provides recommendations related to the accomplishment of the research goal and objectives.

7.3 Accomplishment of Research Goal , and Objectives

The goal of this research was to contribute to the improvement of functional and indoor environment design and operation of work spaces in university facilities. This goal was achieved with the help of two research objectives. The first objective was to develop a survey using identified evaluation factors that would indicate the functional and indoor environment performance of university renovated office settings. The second objective was to develop a method/process for universities to conduct post occupancy evaluation studies for different settings. The above mentioned objectives were accomplished with the help of the following research steps:

1. Identification of functional and indoor environmental aspects that affect faculty and staff-satisfaction in university work spaces. This was mainly accomplished with the help of literature review, and analysis of interviews.
2. Development of trial POE survey comprised of questions about the identified evaluation factors. This was completed by comparison of existing POE instruments , and coming to the conclusion
3. Proposing a method/process to assess functional and indoor environment performance of university work spaces which included the developed POE survey.
4. Application of the developed POE survey along the lines of the proposed methodology.
5. Development of final survey based on feedback from case study facility administrators, and occupants.
6. Presenting the POE findings for the case study facilities.

7.4 Lessons Learned

This section presents a discussion of the lessons learned from research that was conducted to develop a specific tool and process to assess the functional and indoor environmental performance of university offices using occupant-satisfaction as an indicator. The objective behind sharing the lessons learned is to assist university administrators or other researchers in improving future POEs. The limitations of this study such as target population group, space-type, and evaluation factors form the basis of recommendations for future research directions or follow-up studies in the realm of POE at universities.

7.4.1 Lessons learned from Literature Review

In this study, a wide variety of POE-related literature was reviewed in order to study existing POE processes, methods, and instruments especially applicable in university or higher education environments. Considering that literature is extremely significant in this type of study and that university campuses consists of a variety of facility types, literature reviewed must be paraphrased/summarized and documented in an organized fashion from the start. For example, information may be sorted or arranged in categories such as: POE building type, POE factors, POE processes POE questionnaires, POE raw literature, and POE studies on campus. This sorted-out information will support future research in many ways and may be referred to by facility/building/organization managers/administrators throughout the building life cycle. A comprehensive literature review can be an efficient way to learn from experience and efforts of others, which will save costs and also provide for benchmarking through publications. Initially a few main

categories may be created under which relevant/corresponding information attained from literature may be stored chronologically and according to type. In the future, sub categories may be created based on need to do so. This may be a collection of Excel spreadsheets, MS word files, and or PDFs or images stored in electronic folders categorically and chronologically as shown in the illustration below:

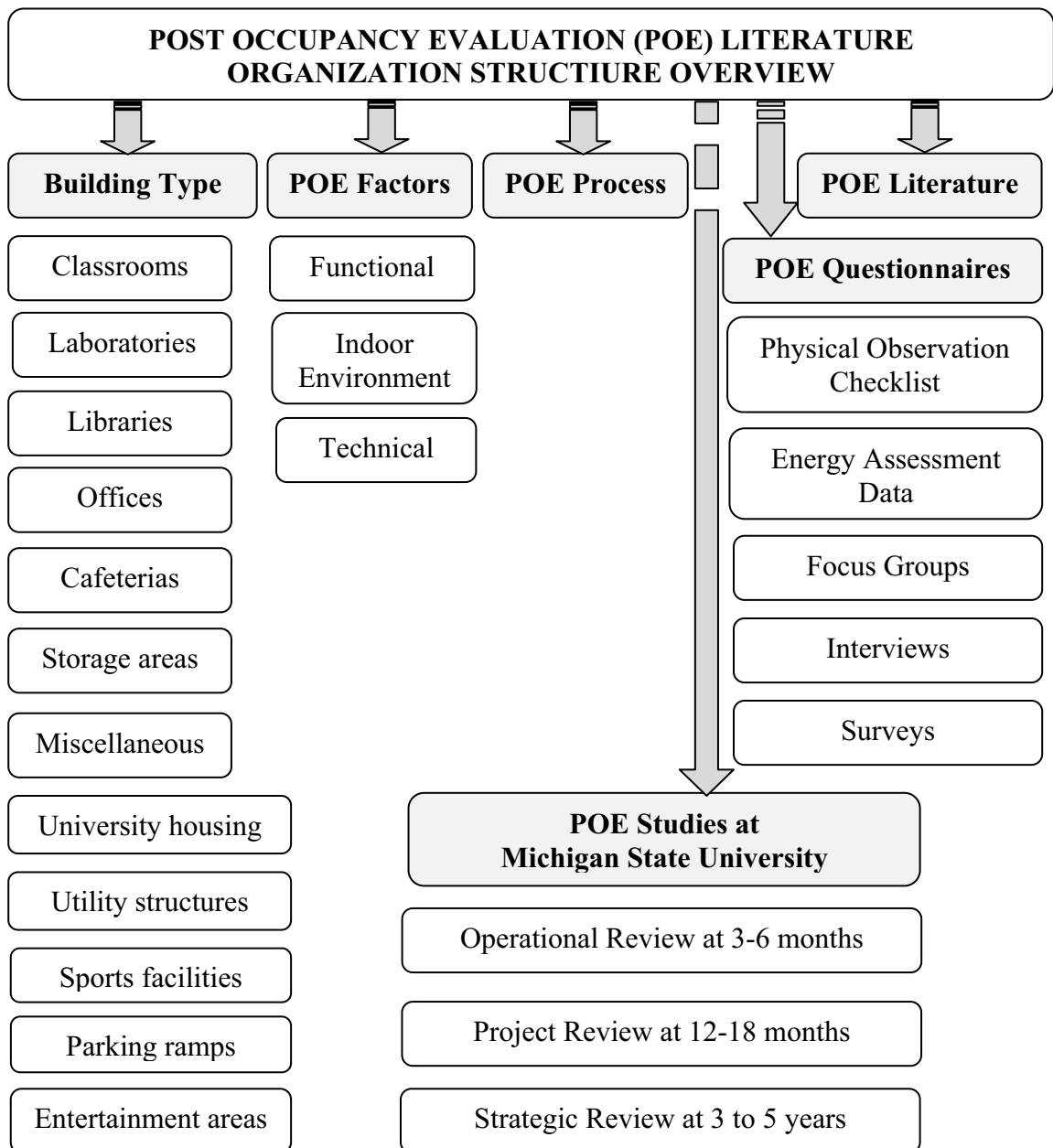


Figure 7.1 Suggested Literatures Database “Post Occupancy Evaluation”

7.4.2 Lessons learned from Interviews

The timing for interviews in universities is a very significant factor that may influence the responsiveness of participants. It was observed during this study that winter was the best time to conduct interviews of university administrators, managers, and inspectors. Most university representatives are busy from late-spring through mid-fall since most of the construction planning and execution happens during this time. On the other hand, planners and designers have a fairly similar schedule all year round. This is especially true in colder climatic areas due to extreme weather conditions where most construction is planned around summer and fall.

In this study it was observed that in-person individual interviews were extremely effective for university representatives/administrators especially those in high profile positions. It gives a sense that it is more interactive and personalized and allows the respondent to feel more comfortable and share un-tainted opinions due to protected privacy by terms of confidentiality (research protocol).

Although it seemed that some questions in the questionnaire were irrelevant or repetitive depending on if the respondent was a designer or a administrator or a manger or a construction inspector. Therefore, it was concluded that a questionnaire tailored to each group such as designers, facility managers, and administrators may be of additional help. Some questions for all groups must be similar to enable comparative analysis and some questions must be particular to their roles and responsibilities towards university facilities. Overall, the interview phase is significant in that it sets the momentum for the remaining phases of the POE process and that it captures opinion and expectations of the university providers.

7.4.3 Lessons learned from Surveys

The findings of this study confirmed that building occupants preferred a web-based survey format over a paper-based format as used in this current study. This was helpful to gather responses, especially if a larger population was being surveyed, although a few occupants preferred a paper-based format. The survey feedback responses also indicated that the use of a web-based format could also reduce the efforts of the evaluators in the analysis phase. This would also facilitate the creation of a reporting database and its integration with a larger database system that would store and use data from all buildings on campus and would be useful in tracking previous problems encountered, corrective actions taken, their supporting rationale, and final effects.

Based on the literature, the best time for survey distribution is after the occupants have experienced both seasons at least once. At the same time, if more than a year passes by then occupants adjust to the present conditions, may have surrendered to temporary remedies/ solutions, and may not be able to distinguish the real problems. Often any building's present conditions depend on the way it's been used and maintained by occupants and, it may not be a design or construction issue. Surveys can be conducted independently or in combination with other data collection methods such as focus groups, structured interviews, physical observations, and walk-through. For universities, POE can be conducted both among staff/ faculty and students to compare perceptions of performance of common areas.

7.4.4 Lessons learned from Data Analysis

During the analysis of the survey responses, it was concluded that the experience and results from a POE may be enhanced by conducting a separate and prior study to determine the order of preference of evaluation factors for occupants. This is helpful to customize and organize the survey questions according to occupant groups.

A more detailed study of individual buildings could be used to determine which design features offer the best value. This type of investigation may be able to show the difference between early design expectations, as-built expectations, and operations. For example, with energy, compare design modeled data, number of LEED credits received, measured energy data, and Energy Star score. The ability to collect consistent data from each site is critical for building-to-building comparisons to industry baselines and for building to building comparisons. The impact on building performance needs to be accounted for when there are occupancy changes, lack of required maintenance, and/or unplanned uses of the buildings. The snapshot view of these sustainably designed buildings provides a valuable picture of the overall performance for one year of use. This study is an important first step to making inferences about whole building performance. Future work to identify year-to-year variation in whole building performance could improve the accuracy and depth of this assessment. Future analysis would benefit from multiple years of data for each metric in order to be able to average the data and investigate potential trends.

During the analysis, it was concluded that web-based survey format would have made reporting more efficient and that it would have been easier to record or transfer raw data into formats necessary for statistical analysis. The manual distribution and collection

of surveys was time consuming and cumbersome, although the feedback time was remarkable. It seemed to be very inefficient if any participants lost their copy of the survey, especially if the survey was completed. If it were an online survey, it can be easily retrieved. Additionally, by delivering paper surveys to occupants in their mail boxes, a day was lost as most faculty and staff members check their mail boxes once or twice a day, on their way in or out.

With regard to the type of responses it was felt that responses to close-ended and open-ended questions may be recorded in separate Excel sheets to enable different filter and sort combinations for statistical analysis. The questionnaire in this study may be modified to include additional questions about the particular facility, the nature of the occupant populations, and the project itself (desired outcomes), which would contribute to more accurate and reliable conclusions.

7.4.5 Lessons learned from Application of POE Process

POE must be conducted in a systematic and planned fashion in order to derive maximum benefit from what the process has to offer/ potential from the process. Since the campus has various kinds of facilities in terms of: type of use, nature of population, amount of square footage, level of complexity, and number and type of resources involved. POE for each building must be preferably a distinct separate project with the required resources (budget, staff time, concerned authority permissions, etc) assigned and clearly outlined objectives such that no resources are wasted on diversions which must

not be considered in the first place. The best idea may be to assign small, consistent, and core team to several projects of similar type/kind.

Depending on the resources available, the level of effort may be decided for the POE, which therefore also lays the path for the POE method selection/strategy. The survey method can be used for all three levels of effort depending on the content and structure of questions. A strategic investment in a (periodic) POE may save the unwanted costs of expensive renovation and repair; for example in the Spartan Way, people still complain about white noise, which was actually a noise correction strategy. Similarly in SPDC, motion sensors were installed with the lighting which was intended to save energy but has now become a factor of dissatisfaction among several occupants. Their concern is that this makes the corridors dark when no one is walking around, which is usually the case when people are working continuously at the same time or if one person is in his or her office working continuously without movement. For some faculty members, even their room lights would go off on occasions and this causes tremendous dissatisfaction. In SPDC, doors were installed between corridors and the stairwell for security purposes. In reality this also causes the corridors to become warmer than comfortable and claustrophobic for users as it prevents air circulation that was there previously without the doors.

POE may be conducted in two stages to capture the problems and the impact of the solutions. The first POE can be designed to conduct an investigation of problems. Once the findings/ results are analyzed and the issues are clearly defined/outlined, the corrective actions ought to be implemented. Following this, the second POE can be conducted after considerable time has passed and when occupants have experienced

major seasons in their personal work space. This second POE is more to capture, if what was done worked right and if the corrective action impacted an increase in the satisfaction levels of building occupants.

At universities, where many "hierarchical levels" and departments are involved, communication can be either becomes a great source of help or obstacle towards the POE process. Good working relationships are greatly required, which will go a long way in conducting several POEs on campus. This is unlike a single and typical office building or any other kind of single facility. Relations built with occupants on first encounter will impact the quality of data collected. Additionally with regard to the "Dimensions of POE", the breadth of focus can be different for different population groups even if in the same building. Therefore, data collection for common shared spaces from all population groups will yield a more comprehensive perception of occupants.

"Given that each facility occupies a unique place and time, there is more art than science to this. Because a building is inherently complex, an evaluation of building performance can cover an overwhelming array of technical, functional, social, and aesthetic issues. However, it is rarely practical or necessary to evaluate all aspects of a facility, so there are many varieties of POE, based on the purposes they serve and the level of effort involved." *Stefani Danes*

Even though a standard process may be laid out, certain aspects are still very specific to the project scope, facility type, etc. There may be many trial and errors before a scrupulous and comprehensive process may be laid out. It is important that the existing project delivery process of the concerned university may be laid out first to tailor-fit the process with consideration to available resources and desired outcomes, and the long-

term goals of the campus (master plan). The process must be flexible enough that it can be modified to enhance the evaluation experience for each facility.

7.4.6 Lessons learned about POE Project Team

It would contribute to the effectiveness and efficiency of POEs if the project team represented all departments that must be kept informed at all stages about all aspects of the evaluation. The best way to do that would be to have individual representatives from all departments that are involved in the planning, design, construction, and operation of university facilities regularly. The POE team must include a design representative (or his assistant/subordinate who are aware of design concepts) as it adds direct learning from projects. In universities, multiple departments are involved in the design, construction, and maintenance of facilities and as more and more POEs are conducted, uniform/consistent communication and documentation can become a challenge. This can be overcome in the start when a system is being put in place so that this aspect is in control, by appointing an exclusive POE team.

Costs of the POE may be distributed among the various stakeholders in more than one form. For example, the university administration can assign a budget and hire a third party/researcher/consultant to appoint a single point of contact as the POE coordinator who will be responsible for the overall POE and coordination. The designer along with the facility manager can contribute manpower to the POE team for data collection. They will report and coordinate with the project coordinator. Once the problems/issues in the building are identified and a corrective action is decided, then the constructors can supervise the execution of the same. The resources required at this point can be funded by

the university administration. Designers can take responsibility for reporting the details of the process throughout.

7.4.7 Lessons learned about POE Factors

A study of order of preference of evaluation factors must be conducted prior to planning and design of a new or renovated facility, which must then be used to outline the factors for measurement of occupants' satisfaction. For example, based on occupant response, the order of preference at SPDC was different from that of the Spartan Way. At SPDC, 20% of the respondents, mainly faculty, complained about lack of sufficient storage space for student material. The concern for staff in the same facility was mostly about lack of personal control of HVAC. In the Spartan Way, 21% of the respondents complained about too many cubicles and no conference room in the building. Also for example, "Ease of interaction with co-workers" is a factor in both facilities but in SPDC, "Ease of interaction with students" becomes a factor too in SPDC as occupants also consist of faculty and not only staff as in Spartan Way.

7.4.8 Lessons learned about POE Questionnaire

Based on occupant responses it was concluded that satisfaction with common areas impact overall satisfaction of occupants. Therefore questions regarding other areas must be included in POE questionnaires. Additionally, correlation questions must be included with consideration to occupants' satisfaction with organization culture/ structure and individual work responsibilities. To be able to locate or identify if there are any secondary issues independent of functional and indoor environmental performance.

Design must be laid out depending on the primary work activities and order of preference of factors can be paired or grouped to better understand and cater to occupants' requirements through design. Also, primary work activities and order of preference of factors can be paired or grouped to better understand and cater to occupants' requirement from design. New technology in both buildings is a concern and a factor of dissatisfaction, therefore, designers can look for/implement more constructive approaches for implementing new technology. For example, may be testing any new technology first in a smaller area with a few occupants. If this small number of occupants is dissatisfied, then the problems can be corrected with lower costs and application on a larger area can be avoided. Additionally, if it's a very small percentage dissatisfied, then the corrective action can begin from smaller and/or simpler problems, which will also allow more time to plan an action/method/strategy, to put together resources, and to negotiate costs for complex and larger problems.

The data collection methods/ strategies/ instruments should be an opportunity for appreciation as much as it is for constructive criticism for the building design. It is very important to know what kind of information is being targeted here and accordingly, questions/ instruments must be designed. Additionally, data analysis methods must be employed in order to satisfy the required report format.

7.5 Conclusions and Inferences

This section summarizes the conclusions drawn from the literature review, interviews of university personnel, and the feedback obtained on the trial POE survey from building occupants. The literature of post occupancy evaluation and the interviews

emphasized the evaluation factors/aspects and methods that are significant while conducting evaluation studies. Most of the POE factors and methods stated in the literature were also reported by the interviewees. These factors and examples of similar methods were used to develop the trial POE survey. This trial POE survey was used in two university facilities to gather occupant feedback with regard to its usefulness and effectiveness. Next, occupant feedback was analyzed qualitatively and quantitatively to derive conclusions with regard to changes needed in the trial POE survey to make the modified version more comprehensive and efficient.

The data collected from the application of the trial POE survey emphasized the significance of this study. However, it was realized that a survey would be more useful and seem comprehensive to occupants if common areas were also evaluated along with their personal workspace. The data indicated that faculty members were affected by performance of student spaces in addition to their own. Finally, it was found that a web based survey version would be most useful for universities since they use several kinds of databases that maintain building performance records, and this will only add to that pool.

7.6 Research Benefits and Contribution

This study renders a two-dimensional benefit for university providers and users by providing them with a method (process flowchart and recommendations) and tool that would add value to building design and operation, and also continuously improve process of facility management.

This study contributes to the ability of universities to identify the elements of the physical work environment that will further enhance the work experience of their

occupants and also have positive influence on recruitment, retention, and work performance or productivity of faculty, staff, and student populations by providing a processes were used to develop a trial POE survey to continuously track occupant satisfaction and thereby enhance performance of their building design for users.

Additionally, the process and survey developed during the study will facilitate a periodic dialogue between the building occupants and managers about their changing environmental need and preferences. The survey will be instrumental in collecting user feedback that will support future decisions, and expenditure towards design and construction for university facilities.

7.7 Future Research Directions

This focus of this study was to evaluate the performance of function and indoor environment in renovated office spaces within universities by investigating the satisfaction level of users. The limitations of this study form the basis of suggestions for future research.

Universities accommodate various functional areas due to the different population groups such as students, faculty, and staff. Therefore as a direction for future research, it is recommended that the methodology, and survey used in this study be further enhanced to evaluate other specific areas such as classrooms, libraries, laboratories, studios, conference rooms, custodial and common areas such as cafeterias, auditoriums, restaurants, parking ramps, outdoor interaction spaces, toilets, storage areas , and student lounges that have been excluded in this study.

Buildings may be evaluated for functional, technical, indoor environment or overall performance which may be conducted at any phase during its life cycle such as programming, planning, design, construction or occupancy. This study focused on the functional and indoor environment factors/aspects only. Excluded factors/aspects are considered to be potential directions for future research.

The post occupancy evaluation criteria for this study was established qualitatively based on literature review, and responses from exploratory interviews that were conducted among university owners, administrators, staff , and architects. It is recommended that further research be conducted using quantitative methods to verify the evaluation criteria. Also, the developed survey was tested in two renovated facilities within one university. To further enhance the survey, it may be tested among more facilities within the same or among different universities.

7.8 Chapter Summary

This chapter concludes this research by discussing the overall research scope, accomplished research goal and objectives, lessons learned, recommendations, final research conclusions, study limitations, and directions for future research.

APPENDICES

APPENDIX A

INTERVIEWS

A1: Interview Consent Form

A2: Project Abstract

A3: Interview Questionnaire

A4: Interview Response Record Sheet for Qualitative Analysis

Appendix A1: Interview Participant Consent Form

PARTICIPANT CONSENT FORM

University Owners, Administrators, Staff and Architects

DEVELOPMENT OF A POST OCCUPANCY EVALUATION INSTRUMENT TO ASSESS OCCUPANT SATISFACTION IN UNIVERSITY RENOVATION PROJECTS

Principal Investigator: Tim Mrozowski and Tariq Abdelhamid

Research Assistant: Sagata Bhawani

The Center for Construction Project Performance Assessment and Improvement (C2P2Ai) from the School of Planning, Design and Construction at Michigan State University is conducting research in order to develop a Post Occupancy Evaluation (POE) method for assessing user satisfaction in recently completed university construction projects with emphasis on university office renovations. As an experienced administrator or designer your insight will be valuable as we develop an instrument. Your responses will be used to help identify important questions that a POE process should address. The outcome of the project will be a POE tool which is useful in operating facilities, identifying necessary corrective actions and providing feedback for future design projects.

As a participant in this research, you will be asked a series of open ended questions relating to post occupancy evaluation in an interview setting. Your participation is voluntary and you may choose to terminate your involvement in this study at any time during this project. If you are uncomfortable at any time during the questioning, you may terminate and withdraw from the interview. You may refuse to answer any particular interview question. Your privacy will be protected to the maximum extent allowable by law. If you are employed by a commercial firm, neither you nor your company will be identified by name in any reporting. However, your title (e.g. Project Manager) may be reported. If you are employed by a university, your name and title will not be used but the university you work for will be identified. The estimated time to complete this interview is approximately 45-60 minutes. As a participant, you may request a copy of this consent letter for your records.

Funding for this project is indirectly being provided by the MSU Office of the Vice President for Finance and Operations as C2P2Ai funding comes from that office. The researchers are employed by Michigan State University. The findings of the study will be available at the end of the research through a report. If you request a copy of the report it will be furnished to you. The data collected will also be used for a graduate Master's thesis.

If you have any questions about this project, you may contact:

Tim Mrozowski, A.I.A., LEED ® AP

Professor of Construction Management, School of Planning, Design and Construction, Michigan State University, (517) 353-0781- mrozowsk@egr.msu.edu

Sagata Bhawani

Graduate Student and Research Assistant, Construction Management Program, School of Planning, Design and Construction, Michigan State University, (517) 648-6277- bhawanis@msu.edu

Appendix A2: Project Abstract

PROJECT ABSTRACT

DEVELOPMENT OF POST OCCUPANCY INSTRUMENT TO ASSESS OCCUPANT SATISFACTION IN UNIVERSITY RENOVATION PROJECTS

Principal Investigators: Tim Mrozowski and Tariq Abdelhamid

Research Assistant: Sagata Bhawani

Post occupancy evaluation (POE) can be defined as the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time. It is any and all activities that originate out of an interest in learning how a building performs for its occupants. The results provide architects with information about the performance of their designs and building owners with information useful for operating and improving their facilities.

The goal of this research is to improve functional performance and indoor environment design and operation of work places in university buildings. The primary product of this research will be a step-wise POE process and instrument for measuring occupant satisfaction relative to functional and technical performance and indoor environmental quality.

The methodology for the study includes: 1) review of literature relating to POE, project post-mortems, post construction assessments and occupant-satisfaction 2) Interviews of up to ten university owners, administrators, staff and consulting architects to obtain insight and recommendations for development of the POE instrument and process, 3) development of a POE instrument to assess building occupant satisfaction and 4) evaluate the POE tool through use in two case study projects 5) The data will be analyzed to modify the POE and to develop conclusions and recommendations about the POE process. Administration of the POE tool in the case will be by separate IRB or an amendment to this IRB.

The outcome of the project will be the development of a POE process tool applicable to university settings with a focus on office environments and renovation projects. The tool if utilized should help to facilitate improved design and more effective operation of buildings through assessing the performance of completed buildings.

Appendix A3: Interview Questionnaire

Construction Project Performance Assessment and Improvement (C2P2AI)
School of Planning, Design, and Construction, Michigan State University

POE INTERVIEW QUESTIONNAIRE

University Owners, Administrators, Staff and Architects

Evaluation processes:

- 1) Do you currently conduct any of the following? Explain/identify.
 - a) Project post mortems/ project performance evaluation (description of items: contract, schedule, budget, procurement, safety, change orders, punchlists, etc)
 - b) Post occupancy evaluation (POE) (building performance evaluation after occupancy)
 - Technical
 - Functional
 - Indoor environment
- 2) If you conduct any of the above processes do you have a standardized approach? Is this process written? If so may we obtain a copy of any instruments used or process descriptions?
- 3) If you do conduct such processes, how is the information used? Does information collected serve primarily as a facility management tool, diagnostic tool, to identify corrective measures for the specific project or is it used for information for improving future projects or processes.
- 4) If your organization does not typically conduct POE, why not? What barriers do you experience or anticipate?

- 5) If your organization does not typically conduct Project Post Mortems, why not? What barriers do you experience or anticipate?
- 6) If you decide to conduct a post occupancy evaluation to determine user-satisfaction, what will be the steps that you will take to ensure the process has sufficient resources (e.g. budget, evaluators, evaluation tools, etc) for execution?

Evaluation aspects:

- 7) In your capacity as a university building or facility owner list aspects in the following categories which you would like to have evaluated after occupancy? Explain.
 - a) Functional evaluation
 - b) Technical evaluation
 - c) Indoor environment quality (IEQ) evaluation
- 8) What kind of questions would you like to be asked of building users?
 - a) Functional performance
 - b) Technical performance
 - c) Indoor environment performance in buildings
- 9) When would you like to have this evaluation conducted for the first time and why?
- 10) How often would you like to have evaluation done in the life cycle of your building or facility?

- 11) How useful as source of information do you consider surveying building occupants to be with regard to building performance?

Types of performance	To great extent	To some extent	To little extent	Not at all	Do not know
Functional					
Technical					
Indoor environment					

- 12) How accurate do you consider building occupants with respect to assessment of building performance?

Types of performance	Highly accurate	Moderately accurate	Little accurate	Not accurate	Do not know
Functional					
Technical					
Indoor environment					

Post occupancy evaluation:

- 13) Please indicate your belief about the usefulness of POE to assess

- a) Functional performance
- b) Technical performance
- c) Indoor environment performance in buildings

- 14) What do you believe are the specific benefits that you perceive from conducting user satisfaction studies?

- 15) Does your organization use clear program statements or owner project requirement statements which describe the functional objectives of projects?

- 16) How are these program statements developed? (I.e. design team, user oriented committees, professional programming consultants or experts, any other. Please specify.
- 17) Are these program and owner project requirements used as a basis for any POE processes?
- 18) Are Owner Project Requirements (OPR) and technical Basis of Design (BOD) statements established for any technical performance or indoor environmental quality objectives?
- 19) Does any technical POE or performance evaluation process utilize these OPR or BOD documents as a basis for assessment?
- 20) How are these BOD statements developed? (Codes, technical data, organizational standards, any other. Please specify.)Who develops them?
- 21) Do you use “commissioning” on your major projects? If yes, do you believe it has led to improved occupant satisfaction in your buildings? Explain.
- 21) Does using commissioning have any influence on the need to conduct POE or how a POE should be conducted? Explain.

- 23) How feasible are the following while conducting POE studies?
- a) Walk-throughs/ physical observation
 - b) Progress photos
 - c) Structured interviews
 - d) Focus groups
 - e) Web-based surveys
 - f) Paper-based surveys
 - g) Building inspection
 - h) Workshops
 - i) Financial analysis
 - j) Assessment of facility maintenance records/ work orders
 - k) Any other. Please specify.
- 24) Would using any of these tools in combination be helpful? (Refer to Q23).
- 25) Who should collect and analyze the information from occupants? (Internal staff, outside consultant, design consultant, any other, please specify)
- 26) In terms of cost, what percentage of overall project budget should be reserved for POE? Why?

Appendix A4: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 1	RESPONSE 2
1	Do you currently conduct any of the following? Explain/identify.	No	
a	Project post mortems/ project performance evaluation (description of items: contract, schedule, budget, procurement, safety, change orders, punch lists, etc)		We have started some: development of scorecards for various project participants such as suppliers, architects, customers. We also have a questionnaire for contractors that evaluate EAS performance. Also, the CPA provides quarterly and annual reports for Fred Poston's office.
b	Post occupancy evaluation (POE) (building performance evaluation after occupancy)		No formal process. During past year we did technical evaluation for 4 large projects: Computer center, Duffy Daugherty, public spaces in Holden Hall and Engineering Building lobby. Also, we do commissioning which satisfies the technical and IEQ but exclude the functional evaluation.
i	Functional		
ii	Technical		
iii	Indoor environment		
2	If you conduct any of the above processes do you have a standardized approach? Is this process written? If so may we obtain a copy of any instruments used or process descriptions?	NA	Refer copies of score cards provided

Table A4.1: Interview Response Record Sheet for Qualitative Analysis

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 1	RESPONSE 2
3	If you do conduct such processes, how is the information used? Does information collected serve primarily as a facility management tool, diagnostic tool, to identify corrective measures for the specific project or is it used for information for improving future projects or processes.	NA	NA
Indoor environment quality (IEQ) evaluation			
4	If your organization does not typically conduct POE, why not? What barriers do you experience or anticipate?	The organization does not or cannot conduct POE or Post Mortems due to absence of a leader who will bring together all the components and execute the process; and, absence of the process itself. Due to lack of information with regard to what would be the evaluation components, who will conduct it and which all other disciplines should be involved in order to facilitate interaction and communication related to the project in one room. For example, how do we evaluate steam tunnels or roads on campus?	In universities, physical plant maintains space. In MSU, Athletics and Housing pay PP for maintenance for others; cost is a barrier which must be embedded in the project. There is no funded source of revenue to pay for this kind of activity yet in MSU.
5	If your organization does not typically conduct Project Post Mortems, why not? What barriers do you experience or anticipate?		

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 1	RESPONSE 2
6	If you decide to conduct a post occupancy evaluation to determine user-satisfaction, what will be the steps that you will take to ensure the process has sufficient resources (e.g. budget, evaluators, evaluation tools, etc) for execution?	There are resources; what is absent is a process and the sense of appropriate time-lines. The organization needs a process with appropriate time-lines such that it makes the whole system more effective and accordingly distributes the people-time over activities.	Project budgets will have to carry POE costs. Also, it should be determined if POE truly adds significant value to building performance. For example, if we are working towards energy cost reduction, then it's difficult to maintain the reduced costs if the building square footage increases in a renovation.
	Evaluation aspects:		
7	In your capacity as a university building or facility owner list aspects in the following categories which you would like to have evaluated after occupancy? Explain.	Physical flow of people traffic and communication; layout of furniture and other furnishings; cables and cords for computer and other appliances; location of equipments and appliances; condition of equipments and appliances. Color selection; Carpet selection and color;	Office space assignments and program adequacy; user comfort; occupant's understanding of what is being built; assessment of spatial relationship in buildings; user involvement in design phase using BIM since they do not understand 2D well.
a	Functional evaluation	lighting levels, thermal comfort levels, acoustics; storage and its form; location of miscellaneous things like the waste baskets, paper recycle boxes.	These aspects are taken care of by commissioning
b	Technical evaluation		

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 1	RESPONSE 2
8	What kind of questions would you like to be asked of building users?	<p>"Did the office function for users as intended in terms of people traffic and communication? If given a chance, what would you redo about your office space? Are we in or out of planned budget? What other options did users have that affects the costs? Is the perceived privacy satisfactory, Is the acoustic quality satisfactory and are the lighting levels supportive of the staff functions"</p>	
a	Functional performance		Does the space perform as envisioned and support all your functions?
b	Technical performance		Occupants can only experience the effect of technical problems which disturbs their comfort level and complain that it's too cold or too hot, but cannot point out the cause. To find out the cause or assess technical performance, the HVAC room or electrical room has to be checked on a regular basis. Therefore, I am not sure if technical questions may be asked of occupants.
c	Indoor environment performance in buildings		
		The respondent has provided with questions that have been previously used for evaluations.	
9	When would you like to have this evaluation conducted for the first time and why?	4-6 months which is neither too early that the occupants have not settled or too late that they have completely got used to their new space.	6-12 months, before that its waste of time and resources; as because, occupancy takes place after substantial completion and there is still work being done until final completion and then we have the punchlist

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 1	RESPONSE 2
9	Continued		Can we verify occupant responses with punchlist items? If aspects not performing well indicated by occupants in their surveys match the punchlist items will that demonstrate accuracy of information provided by occupants with regard to building performance?
10	How often would you like to have evaluation done in the life cycle of your building or facility?	May be 5 years that is if we have the money. It is money driven.	Depends on the complexity of building. In retro-commissioning we do evaluation every 2 years for complex buildings and every 5 years for less complex buildings.
11	How useful as source of information do you consider surveying building occupants to be with regard to building performance?		
	Functional	To a great extent	To great extent
	Technical		To some extent
	Indoor environment		
12	How accurate do you consider building occupants with respect to assessment of building performance?	Highly accurate; since they live in it.	
	Functional		Highly accurate
	Technical		Little accurate
	Indoor environment		

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 1	RESPONSE 2
	Post occupancy evaluation:		
13	Please indicate your belief about the usefulness of POE to assess		
	Functional performance	Highly useful	Very useful and effective
	Technical performance		Already considered in commissioning
	Indoor environment performance in buildings		
14	What do you believe are the specific benefits that you perceive from conducting user satisfaction studies?	The benefits of POE are: Incremental changes in QC, staff productivity and employee attitude which affects the organizational outcomes.	Correct existing problems; influence future designs
15	Does your organization use clear program statements or owner project requirement statements which describe the functional objectives of projects?	Do not know	FPSM prepares program statements and EAS has construction standards which has a section for general planning requirements which are considered to achieve project objectives
16	How are these program statements developed? (I.e. design team, user oriented committees, professional programming consultants or experts, any other. Please specify.		FPSM develops it

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 1	RESPONSE 2
17	Are these program and owner project requirements used as a basis for any POE processes?		Usually shortcomings in projects represent shortcomings in program statement or standards; which are used to improve future project performance
18	Are Owner Project Requirements (OPR) and technical Basis of Design (BOD) statements established for any technical performance or indoor environmental quality objectives?		Standards specify IE limits and design program specify special needs; in addition it also depends on the nature of the building that is to be constructed. For example, Art museum will have different IEQ standards as compared to office areas
19	Does any technical POE or performance evaluation process utilize these OPR or BOD documents as a basis for assessment?		Design program and construction standards
20	How are these BOD statements developed? (Codes, technical data, organizational standards, any other. Please specify.)Who develops them?		Updated constantly based on experience in maintenance and repair of buildings
21	Do you use “commissioning” on your major projects? If yes, do you believe it has led to improved occupant satisfaction in your buildings? Explain.		Yes, definitely

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 1	RESPONSE 2
22	Does using commissioning have any influence on the need to conduct POE or how a POE should be conducted? Explain.		Yes, all except functional performance
23	How feasible are the following while conducting POE studies?		
a	Walk-throughs/ physical observation	x	
b	Progress photos		
c	Structured interviews	x	
d	Focus groups	x	
e	Web-based surveys		x
f	Paper-based surveys		
g	Building inspection	x	
h	Workshops	x	
i	Financial analysis	x	
j	Assessment of facility maintenance records/ work orders	x	x
k	Any other. Please specify.		
24	Would using any of these tools in combination be helpful? (Refer to Q23).	yes	yes
25	Who should collect and analyze the information from occupants? (internal staff, outside consultant, design consultant, any other, please specify)	CPA	2 parties: FPSM should be involved in functional performance assessment and PP in tech and IE performance
26	In terms of cost, what percentage of overall project budget should be reserved for POE? Why?	CPA has reserved budget for evaluations. They are the responsible unit but now we need a process.	Commissioning has 0.5% reserved which includes tech and IEQ, therefore, for functional another 0.25%

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
1	Do you currently conduct any of the following? Explain/identify.	No	Evaluation of project participants are done with score cards; also, 'project de-briefing' is done by design and construction representatives; We do an informal session for 'lessons learnt' to highlight the good and bad experiences during a project. Many things are done but none of it is formally documented and that a formal process is required.
a	Project post mortems/ project performance evaluation (description of items: contract, schedule, budget, procurement, safety, change orders, punchlist, etc)		
b	Post occupancy evaluation (POE) (building performance evaluation after occupancy)	We do not have a formalized process as we get calls whenever there is problem and it is resolved immediately. We do not see any value in conducting unless we know that the client/ users are dissatisfied.	No but a building user's evaluation is required to obtain knowledge of the true experience and feelings of occupants. There is no formal process. In the past, we have gleaned some knowledge but it is not documented systematically and thoughtfully.
i	Functional		
ii	Technical		
iii	Indoor environment		
2	If you conduct any of the above processes do you have a standardized approach? Is this process written? If so may we obtain a copy of any instruments used or process descriptions?	NA	Score cards

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
3	If you do conduct such processes, how is the information used? Does information collected serve primarily as a facility management tool, diagnostic tool, to identify corrective measures for the specific project or is it used for information for improving future projects or processes.	NA	For Contractors- scorecards help keep track of contractor's performance. If a contractor is consistently performing below average, they are warned on the basis of prior data and not whimsical analysis. For owners- contractors evaluate and identify areas where owner is not performing well and may be impeding the progress of construction. It is envisioned that this will strengthen owner's performance.
4	If your organization does not typically conduct POE, why not? What barriers do you experience or anticipate?	We do not do it because it is not a part of the process that we presently follow. Other than this there is not specific answer to this question	The worry on part of some potential improvement as failure. Trust is required among project participants to understand that the intention is not to criticize but to get jobs done more efficiently. The anxiety towards the process; building occupant's time; Investment towards evaluator's time and that of planning team, because of the present workload.

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
5	If your organization does not typically conduct Project Post Mortems, why not? What barriers do you experience or anticipate?		Score cards are done to evaluate performance of project participants.
6	If you decide to conduct a post occupancy evaluation to determine user-satisfaction, what will be the steps that you will take to ensure the process has sufficient resources (e.g. budget, evaluators, evaluation tools, etc) for execution?	Make sure we have sufficient budget; that we have a direction from the University Engineer. Presently there is a disconnect between the three main areas: the estimates, design and construction, therefore, a connection between estimate, design and construction from project initiation until completion will be of great help. We must also ensure a project feedback loop from construction to design and estimates which is absent now.	The questions have to have quality. If all answers are positive then maybe the questions are not right. Since the university already considers this process will be an important part in the project delivery process, the VPFO has committed to a finite amount that may be required to conduct POE. Also, the university plans to establish a staff position for POE in the recent future to track building performance evaluation and maintain a repository of findings from projects.
	Evaluation aspects:		
7	In your capacity as a university building or facility owner list aspects in the following categories which you would like to have evaluated after occupancy? Explain.	Evaluation of building or space specific function	Planning goals that were established at the project start and if those were transformed to reality; Envisioned spatial relationship, function and circulation; Floor plan layout
a	Functional evaluation		

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
b	Technical evaluation	Technical decisions (e.g. lighting control systems, heating cooling systems); energy performance/consumption; or any new technology introduced for the first time must be evaluated (for e.g. College of Human Medicine, Secchia has Lutron system must be evaluated to verify if it's true intended purpose is met.	If the mechanical system is performing as intended, was it commissioned properly, are the building users satisfied by its performance. If a new technology is specified, it is functioning well, did it meet the user's need, and was the investment and risk worth.
c	Indoor environment quality (IEQ) evaluation	User comfort; effect of space on attitude; relation with space as human; individual perception	Energy usage, carbon footprints and compliance with LEED standards, if the university meets their own predictions that originated from the initiative towards sustainability. Impact of IEQ on occupant health. Indoor space ergonomic quality, natural light quality, etc; cost versus benefit analysis.

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
8	What kind of questions would you like to be asked of building users?		
a	Functional performance	Does the space work for you as anticipated? Did the space meet your organizational goals and objectives? How do we do it better? Do you get positive feelings about your space? If the building owner is anticipating user's needs and expectations during design, this may cause a disconnect post-occupancy when the predicted needs and expectations do not match the actual.	If spaces provided are working as intended? Is the office size and layout is working? is the office furniture and furnishing ergonomically comfortable and functionally useful? Special Q: For MSU a fixed percentage is reserved for artwork is it truly appreciated or does it go unnoticed, thereby justifying the investment made?
b	Technical performance	Since users are not technically as knowledgeable, not sure they can be asked technical questions.	Was the mechanical system checked after completion of construction?
c	Indoor environment performance in buildings	If their space IEQ supports their job functions and comfort level	How is the lighting? Heating and cooling? Acoustical quality? Extent of privacy? Accessibility? Ability to recycle products?
		The questions should mainly focus on capturing the occupants' perception of their space. Sometimes, unit supervisors speak for occupants which may be a cause for concern as there was no actual user-participation and user-specific details are lost.	

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
9	When would you like to have this evaluation conducted for the first time and why?	9-12 months which may be sufficient time for occupants to have realizations over time about the design intent. Also, the occupants will have mostly experienced extreme seasons to know the overall building performance.	9-12 months for POE, occupants settled by then and will be aware of more serious problems than initial reaction to the good and bad aspects of renovated facility. For PPM, shortly after completion/ final payment
10	How often would you like to have evaluation done in the life cycle of your building or facility?	Depends on: what the building was intended for? Mostly, problems will be revealed within the first year and after that it also depends on how users have treated their space and the overall facility. % years may be a good time duration after which another evaluation may be considered for complex/ large projects.	Not too many times
11	How useful as source of information do you consider surveying building occupants to be with regard to building performance?	Users are not of one type therefore they are very useful to collect information with regard to one particular space type and function. For example, in residence halls, students will be target users for dorm rooms, lobby, cafeteria, reading rooms, etc whereas, the staff will have to be contacted to determine requirements for kitchen, office areas, etc.	

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
	Functional	between great and some extent useful	great extent
	Technical		some extent
	Indoor environment		great extent
12	How accurate do you consider building occupants with respect to assessment of building performance?	As a group they are highly accurate, as individuals little accurate.	
	Functional	between high and moderately accurate	moderately accurate
	Technical		little accurate
	Indoor environment		moderately accurate
	Post occupancy evaluation:		
13	Please indicate your belief about the usefulness of POE to assess	Useful in providing feedback for designs and their impact on users. At the same time, we do not see any value in conducting it which is an added expense unless we know that the client/ users are dissatisfied	Highly useful and profitable for all three
	Functional performance		Physical plant must be included in evaluation as they are responsible for building maintenance
	Technical performance		
	Indoor environment performance in buildings		
14	What do you believe are the specific benefits that you perceive from conducting user satisfaction studies?	We are missing the feedback loop at present which POE may provide. Since we have never tried POE, we do not know the exact benefits, but we perceive that it will capture lessons learnt from projects.	POE can help correct problems in buildings and create alerts for future projects and thereby help develop goodwill amongst customers.

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
15	Does your organization use clear program statements or owner project requirement statements which describe the functional objectives of projects?	Yes.	Yes. Detail program statements
16	How are these program statements developed? (I.e. design team, user oriented committees, professional programming consultants or experts, any other. Please specify.	Usually the estimator interviewees the client to determine what the client wants and what his budget is, then this information is passed on to the designer who prepares the final design program. For some large projects, we conducted user participation surveys and student focus groups. Multi-disciplinary teams come together with the core design team, users to form the planning team and establish the program requirements specific to the project. The planning team includes a wider range of people who are contacted by an email at the project inception.	Colleges or units that need space contact the FPSM. Under the guidance of the FPSM the design program is prepared by the planning team. Then, user oriented committees, architects and engineers challenge the planning team about the design program which further refines it. We have checklist of disciplines that may be included in the planning team. After the design program is established the physical plant engineer is contacted.
17	Are these program and owner project requirements used as a basis for any POE processes?	Not yet but would want it to be that way.	Not yet but we would like to make them the basis. Project specific evaluation can be only done with due consideration to the special needs that were included in the program due to particular reasons.

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
18	Are Owner Project Requirements (OPR) and technical Basis of Design (BOD) statements established for any technical performance or indoor environmental quality objectives?	Yes. We use the construction standards and the general planning requirements now called the design guidelines to ensure the project abides the minimum requirements of MSU	Construction standards are used for energy efficiency evaluation
19	Does any technical POE or performance evaluation process utilize these OPR or BOD documents as a basis for assessment?	Yes. BOD is viewed as minimum requirement for buildings constructed on campus. Based on work done previously with CM faculty, we have now started to design and construct LEED certifiable buildings. Engineers and Architects are required to report energy statements to MSU. Also, now we have contracts between project participants.	No
20	How are these BOD statements developed? (Codes, technical data, organizational standards, any other. Please specify.)Who develops them?	The BOD is formed from the codes, construction standards, general planning requirements (design guidelines), standard operation practices, senior staff and sometimes best practices identified from feedback from past projects are considered while developing the BOD.	Codes; organization standards; fire marshal reviews; parking standards; material standards; design program influence BOD and EAS is responsible to ensure compliance of design guidelines and construction standards.

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
21	Do you use “commissioning” on your major projects? If yes, do you believe it has led to improved occupant satisfaction in your buildings? Explain.	Yes. Starting to use commissioning and believe that improve occupant satisfaction.	Yes but without asking occupants in real it’s only a guess. Retro-commissioning evaluates the technical performance of existing buildings. We have recognized that POE has value but we do not have a standard procedure to apply it.
22	Does using commissioning have any influence on the need to conduct POE or how a POE should be conducted? Explain.	Influences the questions you want to ask; Since HVAC is commissioned and electrical and plumbing are not, POE may be used for those. We also have a group of inspectors who supervise and evaluate installation and maintenance of building systems. Our commissioning agent will be able to provide you with more information in this regard.	Yes. Commissioning will influence POE and vice versa and it will be useful to compare data and correlate between functional and technical performance.
23	How feasible are the following while conducting POE studies?		All, but it will be important to know which ones are most effective; it will also depend on the project type
a	Walk-through/ physical observation	x	
b	Progress photos	x we already do this	
c	Structured interviews	x with users	
d	Focus groups	x during design	
e	Web-based surveys	x most useful	
f	Paper-based surveys		

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
g	Building inspection	contractors, designers, university team already does it therefore of not value in relation with POE	
h	Workshops		
i	Financial analysis	difficult because of the way projects are funded (donation, sponsorships)	
j	Assessment of facility maintenance records/ work orders	X SQUIRE is an initiative in this regard.	
k	Any other. Please specify.		
24	Would using any of these tools in combination be helpful? (Refer to Q23).	Yes depending on the value of the information collected	May have to use in combination because one method may be more effective in looking at a specific area or aspect than another
	INTERVIEW QUESTIONS	RESPONSE 3	RESPONSE 4
25	Who should collect and analyze the information from occupants? (internal staff, outside consultant, design consultant, any other, please specify)	Internal staff. Appointment of evaluator must consider time constraints and person hours	Internal staff will be first preference, or, outside consultant but that will be more expensive. We cannot have design consultants since there will be bias towards success.
26	In terms of cost, what percentage of overall project budget should be reserved for POE? Why?	Depends on who is providing the funding for POE; It should be a part of the cost of the operation. Before adding any percentage, we must verify how much value POE adds to the project performance.	Occupant focused evaluation costs: \$15,000-20,000; in percentage form not more than 0.5% of project cost. Do not know what will be a fair amount.

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 5	Response 6
1	Do you currently conduct any of the following? Explain/identify.	No	The organization has an informal process which is anecdotal but not well planned. It includes a questionnaire with open ended questions which record responses with regard to weakness in planning. The process includes feedback from department heads and physical plant representatives. Sometimes, a complain call is also the reason to trigger the assessment.
a	Project post mortems/ project performance evaluation (description of items: contract, schedule, budget, procurement, safety, change orders, punchlist, etc)		
b	Post occupancy evaluation (POE) (building performance evaluation after occupancy)		
i	Functional		
ii	Technical		
iii	Indoor environment		
2	If you conduct any of the above processes do you have a standardized approach? Is this process written? If so may we obtain a copy of any instruments used or process descriptions?	NA	NA
3	If you do conduct such processes, how is the information used? Does information collected serve primarily as a facility management tool, diagnostic tool, to identify corrective measures for the specific project or is it used for information for improving future projects or processes.	NA	NA

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 5	Response 6
4	If your organization does not typically conduct POE, why not? What barriers do you experience or anticipate?	Lack of resources: time, manpower; lack of a clear well defined process	Time; present workload; shortage of staff; lack of experience with a similar process; lack of realization of value of POE on part of the persons who may be involved; lack of knowledge to use the information gathered in the most effective way; lack of consideration to details of the process.
5	If your organization does not typically conduct Project Post Mortems, why not? What barriers do you experience or anticipate?	Lack of resources: time, manpower; lack of a clear well defined process	Same as above
6	If you decide to conduct a post occupancy evaluation to determine user-satisfaction, what will be the steps that you will take to ensure the process has sufficient resources (e.g. budget, evaluators, evaluation tools, etc) for execution?	It should be assigned as a duty of a single individual who should also belong to the third party	To make time for such a process, will need additional staff; additional finances; a cross functional team that will comprise of lead representatives from FPSM, physical plant, architect's firm and client; right questions; right people to ask; right information collected; right way to use the information gathered.

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 5	Response 6
	EVALUATION ASPECTS		
7	In your capacity as a university building or facility owner list aspects in the following categories which you would like to have evaluated after occupancy? Explain.	It must be evaluated if the building functions have been achieved as intended. For universities, particular areas are more important such as common areas. Other aspects: adequacy of office space, mechanical spaces, maintenance accessibility.	Space quality; sufficiency of space utilization; size; spatial arrangement; sufficiency of spatial functions; Office layout and effect on required communication between occupants; proximity of right functional areas; space support towards task performance; impact of space on confidence and competence of users; representation or organizational values.
a	Functional evaluation		
b	Technical evaluation	Aspects: temperature, humidity, lighting, flexibility, connections (amount and location), technology applications.	
c	Indoor environment quality (IEQ) evaluation	IEQ is a perspective oriented and it depends on how good a person feels in his or her space.	Thermal comfort and more.
8	What kind of questions would you like to be asked of building users?	Does the building enhance your ability to get your work done in an effective and productive manner? If given the chance, what would you change about your space?	How is the space quality? Does the space size, layout arrangement, location, features, furnishing support and enhance your ability to get your work done in an efficient manner? Overall, does the space perform as intended? Is any particular area too far or too close to your space and interferes with your task performance?
a	Functional performance		

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 5	Response 6
b	Technical performance		
c	Indoor environment performance in buildings		
9	When would you like to have this evaluation conducted for the first time and why?	Ideal time may be 6-12 months after occupancy; because if it is earlier then people are already exhausted with the move in efforts so they have mixed feeling about their place; if it is later, then they have settled already and also the organizational goals change with time.	6 weeks from occupancy at least so changes can be made if required before users settle completely.
10	How often would you like to have evaluation done in the life cycle of your building or facility?	3-5 years ideally. The efforts should be justified with regard to values such as, how will the gathered data be used? Are the people involved committed enough?	For new and renovated projects- 6 weeks from occupancy and then a year later for all physical systems. The FPSM has a process called 'space request process' which collects user feedback one year after occupancy. Sometimes users re request more space but when we investigate, it may be only spatial rearrangement that they need.
11	How useful as source of information do you consider surveying building occupants to be with regard to building performance?		
	Functional	to a great extent	To a great extent
	Technical	to some extent	To a great extent
	Indoor environment	to a great extent	To a great extent

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 5	Response 6
12	How accurate do you consider building occupants with respect to assessment of building performance?		While gathering information, the right amount of sample must be considered or appropriate representatives must be approached.
	Functional	Highly accurate	Moderately accurate
	Technical	Moderately accurate	Moderately accurate (They may not be able to provide information about the amount of energy wasted, etc)
	Indoor environment	Moderately accurate	Moderately accurate
	Post occupancy evaluation:		
13	Please indicate your belief about the usefulness of POE to assess		Informative towards future space planning; captures information that may not surface physically (for example: emotional reactions); it adds value such that current problems are detected and future problems are avoided. Items beyond punchlist can be identified. This kind of a process may also promote the feeling that the central university or university leaders care for their employees.
	Functional performance	Extremely useful	
	Technical performance	Lesser useful	
	Indoor environment performance in buildings	Very useful and subjective	

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 5	Response 6
14	What do you believe are the specific benefits that you perceive from conducting user satisfaction studies?	Tells users that organization cares for their satisfaction and well-being; users are more productive which means more dividends for the organization	Good information from building users which may help to identify current building issues and contribute in future planning. Help solve problems when they are small such that they do not become bigger issues in the long run. It helps capture organizational values.
15	Does your organization use clear program statements or owner project requirement statements which describe the functional objectives of projects?	Program statements that comprise of list of space needs from clients but not necessarily does it trickle down to functional objectives.	yes
16	How are these program statements developed? (i.e. design team, user oriented committees, professional programming consultants or experts, any other. Please specify.	Facility planning space management; Designer teams, user oriented committees, professional programming consultants or experts.	All of the mentioned. Initially the architects makes a preliminary design program following which, FPSM along with key occupants and owners finalize it. They conduct a feasibility analysis and then an external consultant.
17	Are these program and owner project requirements used as a basis for any POE processes?	No, but it should be.	Informally
c	Structured interviews	Useful	X Along with walkthroughs will be very useful

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 5	Response 6
18	Are Owner Project Requirements (OPR) and technical Basis of Design (BOD) statements established for any technical performance or indoor environmental quality objectives?	Yes, used as a part of commissioning process	No
19	Does any technical POE or performance evaluation process utilize these OPR or BOD documents as a basis for assessment?	Design documents are used as baseline for commissioning	Informally physical plant uses it
20	How are these BOD statements developed? (Codes, technical data, organizational standards, any other. Please specify.)Who develops them?	All of the mentioned; user input; designer or corporate experience; design professional	Part of the planning team; design standards; reviews of planning process
21	Do you use “commissioning” on your major projects? If yes, do you believe it has led to improved occupant satisfaction in your buildings? Explain.	Commissioning is being used more consistently on most projects now and more than 'satisfaction', a more prominent measure is 'less dissatisfaction'.	Not responded
22	Does using commissioning have any influence on the need to conduct POE or how a POE should be conducted? Explain.	POE still has value with regard to communication. A lot of useful information as per how the building functions is gathered from communication which is the starting point of POE.	Not responded
23	How feasible are the following while conducting POE studies?		

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 5	Response 6
a	Walk-through/ physical observation	Essential and feasible	X (means yes)
b	Progress photos	Helpful to record building problems, with some write-up or comments but not directly for evaluation	X
c	Structured interviews	Useful	X Along with walkthroughs will be very useful
d	Focus groups	Useful	Not very useful
e	Web-based surveys	Useful to some extent; may not capture the kind of feedback we may be looking for	Moderately useful and must have limited questions
f	Paper-based surveys		Not very useful
g	Building inspection	Very useful and important	Already done by physical plant and is useful
h	Workshops		Not very useful
i	Financial analysis		Part of the energy consumption calculations and already done by building maintenance group
j	Assessment of facility maintenance records/ work orders	Already being done	Done already
k	Any other. Please specify.		
24	Would using any of these tools in combination be helpful? (Refer to Q23).	A, c, g together may be very helpful	Yes, walkthroughs and structured interviews.
25	Who should collect and analyze the information from occupants? (internal staff, outside consultant, design consultant, any other, please specify)	Internal staff dedicated solely for POE or outside consultant. Evaluators can work with design consultants but design consultants should not be the evaluators.	Space planning team

Table A4.1 continued: Interview Response Record Sheet for Qualitative Analysis

	INTERVIEW QUESTIONS	RESPONSE 5	Response 6
26	In terms of cost, what percentage of overall project budget should be reserved for POE? Why?	Guess: 0.1%	Depends on how much does a POE cost; It should be expressed in % for small budget projects and "% and not to exceed amount" for large projects.

APPENDIX B
POST OCCUPANCY EVALUATION SURVEY

B1: Consent Form

B2: Trial POE Questionnaire

B3: Survey Response Code Sheet

B4: Survey Response Record Sheet for SPDC

B5: Survey Response Record Sheet for Spartan Way

B6: Survey Feedback Section Comparative Analysis Sheet

B7: Modified POE Questionnaire Paper-based Version

APPENDIX B1

Consent Form

Construction Project Performance Assessment and Improvement (C2P2AI)
SPDC/ Spartan Way Michigan State University
PARTICIPANT CONSENT FORM
Building Occupants

**DEVELOPMENT OF A POST OCCUPANCY EVALUATION INSTRUMENT TO
ASSESS OCCUPANT SATISFACTION IN UNIVERSITY RENOVATION
PROJECTS**

Principal Investigator: Tim Mrozowski and Tariq Abdelhamid
Research Assistant: Sagata Bhawani

The Center for Construction Project Performance Assessment and Improvement (C2P2AI) from the School of Planning, Design and Construction at Michigan State University is conducting research in order to develop a Post Occupancy Evaluation survey to assess user satisfaction in university office renovations.

Post occupancy evaluation (POE) can be defined as the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied.

As a participant in this research, you are being requested to complete a survey questionnaire. The purpose of this survey is to assess your satisfaction level with the functional and indoor environment aspects of your work space. Your participation is completely voluntary. The estimated time to complete this survey is approximately 15-20 minutes. Each survey is coded with unique random numbers to protect the privacy of respondents.

You indicate your voluntary participation by completing and returning the survey in the box marked ‘POE STUDY’ and placed in your mailbox area/room.

If you have any questions about this project, you may contact:

Tim Mrozowski, A.I.A., LEED ® AP

Professor of Construction Management, School of Planning, Design and Construction,
Michigan State University

(517) 353-0781, mrozowsk@egr.msu.edu

Sagata Bhawani

Graduate Student and Research Assistant, Construction Management Program
School of Planning Design and Construction, Michigan State University

(517) 648-6277, bhawanis@msu.edu

If you have any questions or concerns about your role and rights as a research participant or would like to obtain information or offer input, or would like to register a complaint about this research study, you may contact, anonymously if you wish, Michigan State University Human Research Protection Program at 517-355-2180, FAX 517-432-4503, or e-mail irb@msu.edu, or regular mail at: 202 Olds Hall, MSU, East Lansing, MI 48824.

APPENDIX B2:

Trial POE Questionnaire

Post Occupancy Evaluation 2009

School of Planning, Design and Construction

Building Occupant's Survey

The purpose of this survey is to identify important evaluation aspects that a post occupancy evaluation survey should address. Your response from this survey will be useful as we develop the final survey instrument.

Please record your start and end time for completing the survey:

Start time: _____ End time: _____

Section 1: Occupant Satisfaction with regard to Functional Performance

Please note: Functional performance refers to the performance of the design components of your workspace towards your task performance.

On a scale of 1 to 7, where 1=very satisfied, 2=satisfied, 3=slightly satisfied, 4=neutral, 5=slightly dissatisfied, 6=dissatisfied and 7=very dissatisfied, please indicate your level of satisfaction with regard to the following aspects:

1. How satisfied are you with your **office layout** i.e. the placement of your workspace/ cubicle/ rooms with regard to your surrounding workspaces/ cubicles/ rooms?

Very Satisfied          Very Dissatisfied

2. If you are dissatisfied, what would you change about your **office layout**? Please explain.

3. How satisfied are you with the **location of your workspace** in relation to the remaining office area?

Very Satisfied          Very Dissatisfied

4. If you are located in an open office, how satisfied are you with your **office location** in relation to the rest of the functional areas?

Very Satisfied          Very Dissatisfied

5. If you are dissatisfied, what would you change about your **office location**? Please explain.

6. Does your personal work space function well for your job responsibilities?

- ☐ Yes
- ☐ No

7. How satisfied are you with the **amount of space** available for individual work and storage?

Very Satisfied          Very Dissatisfied

8. If you are dissatisfied, what would you change about the **amount of space** available for individual work and storage? Please explain.

9. Does the individual work space function well for the overall office?

- ☐ Yes
- ☐ No

10. If your answer is No, what would you change?

11. If you have a shared workspace does it work well for you?

- ☐ Yes
- ☐ No

12. If your answer is No, what would you change?

13. How satisfied are you with the **ease of interaction** with co-workers?

Very Satisfied          Very Dissatisfied

14. If you are dissatisfied, what would you change about the **ease of interaction** with co-workers? Please explain.

15. How satisfied are you with the **privacy** of your workspace?

Very Satisfied          Very Dissatisfied

16. How satisfied are you with the **visual privacy** of your workspace?

Very Satisfied          Very Dissatisfied

17. If you are dissatisfied, what would you change to improve the **visual privacy** of your workspace? Please explain

18. How satisfied are you with your **office furniture** in terms of comfort, flexibility, sufficiency, overall appearance?

Very Satisfied          Very Dissatisfied

19. If you are dissatisfied, what would you like to change about your **office furniture**? Please explain.

20. How satisfied are you with your **office furnishings** (for e.g. carpet or curtain color, finish, function, overall appearance)?

Very Satisfied          Very Dissatisfied

21. If you are dissatisfied, what would you change to improve the appearance and utility of your **office furnishings**? Please explain.

22. How satisfied are you with your **office equipment and their contribution to your task performance**? (For example: printer, phone, fax machines, computer accessories, etc)

Very Satisfied          Very Dissatisfied

23. If you are dissatisfied, what would you like to change about your **office equipment**? Please explain.

24. How satisfied are you with the ease of **accessibility** to your personal work space from the entrance of your building?

Very Satisfied          Very Dissatisfied

25. If you are dissatisfied, what would you like to change about ease of **accessibility** to your personal workspace from the entrance? Please explain.

26. How satisfied are you with the **access and ability of personal control** in your workspace for heating, ventilation, connection points, and power supply stability?

Very Satisfied          Very Dissatisfied

27. If you are dissatisfied, what would you like to change about the **access and ability of personal control** in your office building? Please explain.

28. Do you have a window in your personal workspace?

- ☐ Yes
- ☐ No

29. If yes, how satisfied are you with the **window location and view** in your personal workspace?

Very Satisfied          Very Dissatisfied

30. If you are dissatisfied, what would you like to change about the **window location and view** in your workspace? Please explain.

If No, to what extent does absence of window affect your overall satisfaction with your personal workspace?

- ☐ To great extent
- ☐ To some extent
- ☐ To little extent
- ☐ Not at all

31. How satisfied are you with your **overall current personal workspace**?

Very Satisfied          Very Dissatisfied

If, this is not your first office and if your first office was in a university setting, please answer the question #31 or proceed to question #32:

32. How satisfied were you with your **overall previous personal workspace**?

Very Satisfied          Very Dissatisfied

33. How satisfied are you with your overall **building renovation**?

Very Satisfied          Very Dissatisfied

34. How satisfied are you with your **overall workplace environment**?

Very Satisfied          Very Dissatisfied

35. How satisfied are you with the **construction quality** (example: product finishes, installations of hardware, etc) of your building after renovation?

Very Satisfied          Very Dissatisfied

36. How satisfied are you with the process/ how satisfied were you with the process of renovation?

Very Satisfied          Very Dissatisfied

37. Do you consider that your needs were incorporated into the design? If not, what was omitted?

38. How has the renovations affected your work performance?

- ☐ Great improvement
- ☐ Moderate improvement
- ☐ Little improvement
- ☐ No affect

39. Other aspects that may affect your overall level of satisfaction or dissatisfaction with your workspace may be the organization structure of your department or your changed job-description.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

Section 2: Occupant Satisfaction with regard to Indoor Environment Quality:

Please note: Indoor environment refers to the overall feel and quality of the space inside your office.

On a scale of 1 to 7, where 1=very satisfied, 2=satisfied, 3=slightly satisfied, 4=neutral, 5=slightly dissatisfied, 6=dissatisfied and 7=very dissatisfied, please indicate your level of satisfaction with regard to the following aspects:

LIGHT

40. How satisfied are you with the **natural lighting** at your workspace?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  **Very Dissatisfied**

41. How satisfied are you with the **artificial lighting** at your workspace?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  **Very Dissatisfied**

42. How satisfied are you with the **visual comfort of the lighting** at your workspace (e.g. glare, reflections, and contrast)?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  **Very Dissatisfied**

43. How satisfied do you feel with the **overall lighting comfort** at your workspace?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  **Very Dissatisfied**

44. If you are dissatisfied, what would you change about your **overall workspace lighting**? Please explain.

THERMAL COMFORT

45. How satisfied are you with the **temperature** in your workspace?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  **Very Dissatisfied**

46. How satisfied are you with the **humidity** in your workspace?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  **Very Dissatisfied**

47. How satisfied are you with the **ventilation** in your workspace?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  **Very Dissatisfied**

☐ Do not know

48. How satisfied are you with the **overall thermal comfort** of your workspace?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  **Very Dissatisfied**

49. If you are dissatisfied, what would you change about your **overall workspace thermal comfort**? Please explain.

AIR QUALITY

50. How satisfied are you with the **air quality** at your workspace (stuffy/stale air, cleanliness, odors)?

Very Satisfied



Very Dissatisfied

51. How satisfied do you feel with the **ventilation** of your office?

Very Satisfied



Very Dissatisfied

52. If you are dissatisfied with air quality, what changes would you recommend? Please explain.

ACOUSTIC

53. How satisfied are you with the **noise level** of your workspace?

Very Satisfied



Very Dissatisfied

54. How satisfied are you with the **sound privacy** of your workspace?

Very Satisfied



Very Dissatisfied

55. If you are dissatisfied, please explain causes for your discomfort.

56. Do you think that the overall indoor environment of your workspace affects your work performance and productivity?

- ☐ Yes
- ☐ No

57. To what extent do you think that indoor environment affects work performance and productivity?

- ☐ To great extent
- ☐ To some extent
- ☐ To little extent
- ☐ Not at all

58. Was there any new technology implemented in your workspace?

- ☐ Yes
- ☐ No

59. If yes, how satisfied are you with the implemented technology?

Very Satisfied



Very Dissatisfied

60. Was there any new technology implemented in your building?

- ☐ Yes
- ☐ No

61. If yes, how satisfied are you with the implemented technology?

Very Satisfied



Very Dissatisfied

Section 3: General Information

62. How long have you been working in this building? Please indicate your answer in number of years.

63. How long have you been working at your *current* personal work space (open workspace/ cubicle/ cabin/ office area)? Please indicate your answer in number of months/ years.

If, this is not your first office and if your first office was in a university setting, Please answer the following question:

64. How long did you work at your *previous* personal workspace/ cubicle/ cabin/ office area? Please indicate your answer in number of months/ years.

65. In a typical week, how many hours do you spend in your personal workspace? Please indicate your answer in number of hours/week.

Which of the following best describes your personal workspace?

- ☐ Enclosed office, private
- ☐ Enclosed office, shared with other people
- ☐ Cubicles with high partitions (about five or more feet high)
- ☐ Cubicles with low partitions (lower than five feet high)
- ☐ Workspace in open office with no partitions (just desks)
- ☐ Other, please specify:

66. What is your gender?

Please indicate your age in number of years below.

67. How would you describe the work you do? Please select all options that apply to you.

- ☐ Administrative
- ☐ Staff
- ☐ Technical
- ☐ Professional/ Faculty
- ☐ Other, please specify.

68. Please list at least five activities that may be part of your role and responsibility. For example, frequent movement within different areas and levels of the building, numerous telephone conversations, and long hours of reading).

Section 4: Post Occupancy Evaluation Survey Evaluation

1. How satisfied are you with the format of the survey?

Very Satisfied



Very Dissatisfied

2. How satisfied are you with the appropriateness of the questions?

Very Satisfied



Very Dissatisfied

3. Please comment on the balance of open ended to closed response questions.

- ☐ Need more open-ended
- ☐ Need fewer open-ended
- ☐ Just right for me

4. In the future, which method of interaction would you prefer for this kind of study?

- ☐ Paper-based (similar to this one)
- ☐ Web-based
- ☐ Interviews
- ☐ Any other? Please specify _____

5. How satisfied would you feel if these questions were asked in a focus group of persons occupying adjacent workspaces as compared to this survey?

Very Satisfied



Very Dissatisfied

6. In your opinion, to what extent did the survey cover aspects that you would like to comment upon about your office?

- ☐ To great extent
- ☐ To some extent
- ☐ To little extent
- ☐ Not at all

7. Do you consider that right questions are being asked of building occupants?

- ☐ Yes
- ☐ No
- Other, please specify _____

8. If 'No', what questions should be asked?

9. Do you think that the survey allows you to effectively indicate your satisfaction with the design of your workspace?

- ☐ Yes
- ☐ No
- Other, please specify _____

10. Please mention any aspects that may not have been included for evaluation of your satisfaction but which may be representative of performance of your workspace function and environment in your opinion.

11. Please list by number any questions that you find unclear or confusing and explain why.

12. Please list by number any questions that you feel were unnecessary.

13. We request you to go back to the start of the survey and enter the 'end time' of the survey before sending this.

Thank you for your participation in this survey!

APPENDIX B3:

Survey Response Code Sheet

Question nos.	Response	Code
Sections 1, 2, and 3- 1, 3, 4, 7, 13, 15, 16, 18, 20, 22, 24, 26, 29, 32, 33-37, 41-44, 46-49, 51-52, 54-55, 60, 62 and Section 4- 1, 2, 5	Very Dissatisfied Dissatisfied Slightly Dissatisfied Neutral Slightly Satisfied Satisfied Very Satisfied	1 2 3 4 5 6 7
Sections 1, 2, and 3- 6, 9, 11, 28, 57, 59, 61 Section 4- 7, 9	Yes No	1 0
Sections 1, 2, and 3- 31, 58 Section 4- 6	To a great extent To some extent To little extent Not at all	1 2 3 4
Sections 1, 2, and 3- 39	Great improvement Moderate improvement Little improvement No affect	1 2 3 4
Sections 1, 2, and 3- 40	Strongly agree Agree Neutral Disagree Strongly disagree	1 2 3 4 5

Table B3.1: POE Survey Response Coding Plan

Table B3.1 Continued: POE Survey Response Coding Plan

Question nos.	Response	Code
Section 3- 66	Enclosed office, private	1
	Enclosed office. Shared with other people	2
	Cubicles with high partitions	3
	Cubicles with low partitions	4
	Workspace in open office with no partitions	5
	Other	6
Section 3- 69	Administrative	1
	Staff	2
	Technical	3
	Faculty	4
	Other	5

APPENDIX B4:

Survey Response Record Sheet for School of Planning Design and Construction

Open-ended Responses for:

Section 1: Functional Performance

Section 2: Indoor Environment Performance

Section 3: Participant Information

	OFFICE LAYOUT	LOCATION OF WORK SPACE	AMOUNT OF SPACE
	2	5	8
1			
2			
3			
4			
5			MSU has no idea about the requirements to complete the job assignment
6			
7	more work space		
8	Faculty rooms are all over the place and difficult to find	NA	Need additional 100 SF for my office
9		No place to move really- but better shades to protect from the sun	
10			
11	removed from faculty with whom I have most contact- organize faculty by major	same as #2	Need more closed general storage. We lack storage for hard copies- student portfolios, etc.
12			
13	More storage space. Computer screen not facing the door		more storage for students drawings and projects
14			More project storage space. More book shelf space. More window space.

Table B4.1: POE survey record sheet for S.P.D.C.

Table B4.1 continued: POE survey record sheet for S.P.D.C.

	OFFICE LAYOUT	LOCATION OF WORK SPACE	AMOUNT OF SPACE
	2	5	8
15	It's a bit small- 50% bigger would be convenient	Overall everything is everywhere. Grad student's office all the way upstairs. Main office downstairs. A more controlled layout in the overall has been better for communication purposes. Also all profs are all over in the buildings. Can't get to see them often if not personally aiming it. Low interaction due to layout.	See Q2
16	We have created our own space, nothing to do with renovations		
17	No response		
18			
19			
20	bigger, more workable area	Not sure, but feel the overall space for workers not designed to the best use of the space	
21		This comment was omitted to maintain privacy but was included in analysis and development of recommendations.	
22		NA	

Table B4.1 continued: POE survey record sheet for S.P.D.C.

	OFFICE LAYOUT	LOCATION OF WORK SPACE	AMOUNT OF SPACE	
	2	5	8	
23			Technology or computers will always have items to be stored. We do not have a room dedicated for this. Currently it is temporary usage of another room.	
24	This comment was omitted to maintain privacy but was included in analysis and development of recommendations.			
25				
26				
27				
	ACCESSIBILITY	ACCESS & ABILITY OF PERSONAL CONTROL FOR HVAC	INCORPORATION OF USER NEEDS	COMMENTS
	25	27	37	
1			Data & power in rooms HE 309/208; data in 109/110 were omitted without our knowledge and assumed we would use wireless for data	
2				
3		There is no control of the heat in our office	No I was never asked what my needs are	
4			This comment was omitted to maintain privacy but was included in analysis and development of recommendations.	

Table B4.1 continued: POE survey record sheet for S.P.D.C.

	ACCESSIBILITY	ACCESS & ABILITY OF PERSONAL CONTROL FOR HVAC	INCORPORATION OF USER NEEDS	COMMENTS
5		Heating or AC is a joke; the light sensors make me quite angry, going off all the time	Very little participation, so much was just dictated	
6			Does not function for the students	
7				
8		Fix the HVAC unit and have individual control units in every room		
9		No control over heat or air conditioning and sun in summer	Color of counter- wish it was wood like desk and not like kitchen counter	
10		Heat in office is high. Thermostats do not seem to control. Have to run AC even in winter		
11		We have constant temperature problem. Controls don't seem to control anything. Motion detectors often terminate the outer lighting. Light switches for individual offices are good.	yes	
12		No personal control. Heating not reliable	yes	

Table B4.1 continued: POE survey record sheet for S.P.D.C.

13		It is too hot always. Temperature cannot be controlled. a thermostat that works	Lockers for students. Not enough display space. More needed on both sides of corridor. Shelves or cables for boards.	
14		No Thermostat. No control at all. At the whim of those next to me who do have thermostat or the main system. Right now it is 48° and raining out and the air conditioner is on.	Adequate number of design studio spaces. Adequate number of general storage	
15		No controls in the room. Always too hot or too cold.	Limited choice for furniture	My level of satisfaction with my workspace is only related to my workspace characteristics. I don't get caught up on hierarchy, inter-departmental relations, etc. especially in considering space.
16	Fourth floor-no elevator	Too hot no room controls		
17				
18	Fourth floor; love the exercise		Absolutely not; doors, storage in studios/ halls; display boards in gallery	
19				
20		Temperature not consistent with, too hot or too cold		

Table B4.1 continued: POE survey record sheet for S.P.D.C.

21			This comment was omitted to maintain privacy but was included in analysis and development of recommendations.		
22			yes		
23			yes		
24			The choices and point system were poorly explained and designed. Extra points for desk drawers, please!		
25					
26			Pretty much		
27	workspace is not handicapped accessible		I do not feel our needs were included in design nor is it functional		
	LIGHT	THERMAL COMFORT	AIR QUALITY	ACOUSTICS	WORK ACTIVITIES
	44	49	52	55	
1	Shared office. Light sensor is blocked on my side by partition; the lights are always shutting down from the partition and lack of movement to the sensor. I work in the dark 60% of my day	Always warm in winter			

Table B4.1 continued: POE survey record sheet for S.P.D.C.

	LIGHT	THERMAL COMFORT	AIR QUALITY	ACOUSTICS	WORK ACTIVITIES
	44	49	52	55	
2					Computer work at desk; meeting with people in office
3		Actual control of heat would be great		There is no sound privacy for my workspace	
4					Long hours of reading; grading; student conferences; frequent telephone conversations; class prep
5	Eliminate the switch, bring my own lighting, the purchase office lamp is quite poor	Give me actual control of heat and AC			Sorry the list is too long
6					frequent movement within different areas and levels of the building; standing in studio for 8-12 hours/ week
7					Clerical
8	More lighting	Fix the heating unit and individual room control			Regular faculty duties

Table B4.1 continued: POE survey record sheet for S.P.D.C.

	LIGHT	THERMAL COMFORT	AIR QUALITY	ACOUSTICS	WORK ACTIVITIES
9		Sometimes it feels so "stuffy" that I can't breathe. Sun made it warm no control of thermostat		Everyone can hear my phone conversations or speaking to visitors	Receptionist. Computer work. Travel vouchers. Sort mail
10		Office is hot and thermostat does not seem to control heat. Need to run AC in winter	As far as I can see there is no air movement or ventilated system in office.	Loud co workers and noise carries even with door to personal office closed.	Customer service. Review of documents. Interaction with others. Computer work.
11		System does not work properly. It has frequent performance problems			Frequent movement to classrooms. Advising office. Computer work. Use conference room, frequent meetings.
12		Settings do not seem to work, sometimes is too hot, other times too cold			
13		Too hot. Like in an oven in all seasons	Too much dust- not cleaned regularly		Mainly teaching-preparing class material, grading

Table B4.1 continued: POE survey record sheet for S.P.D.C.

	LIGHT	THERMAL COMFORT	AIR QUALITY	ACOUSTICS	WORK ACTIVITIES
14		I have no control. The heat has a mind of its own. Some mornings it feels like 90, other times its cold. A thermostat to control the temperature in my office		Can hear conversations from offices on either side at times. Not bad though for the most part	Reading; writing (exams, lectures); grading (papers, projects, models, art); electronic communication (email); student advising/ class office hours
15		It's either too hot or too cold. No personal controls within the room. I have to open the door for ventilation. Its good in terms of natural ventilation but then it affects the privacy of personal space when needed.	Q 49	I can hear everyone. Not comfortable at all.	Frequent movement within different areas and levels of the building, numerous telephone conversations, and long hours of reading.
16		Keep windows open and its fine. Loss of energy due to lack of room thermostat.			
17		Need personal control		Very uncomfortable to talk on the phone due to poor acoustics	Long hours using computer; frequent use of scanner; piling up student projects
18					frequent movement within different areas and levels of the building; time in studio; meetings with students in office

Table B4.1 continued: POE survey record sheet for S.P.D.C.

	LIGHT	THERMAL COMFORT	AIR QUALITY	ACOUSTICS	WORK ACTIVITIES
19		Window AC is noisy and oversized			Grade assignments, assist students
20		not sure- temperature not steady		noise is not an issue but you can hear what others are saying	mostly word processing, copying, calling for information
21	if it could be placed on the wall instead of directly under where I sit				frequent visits to the main office to drop stuff that need to be signed or approved, also going to the mail room at least twice a day
22					
23		We don't have air flow vented in the ceiling but do open our windows. This works for us.			Tech support for the school- some individual offices, others in my office
24					
25					Small meetings, movement around floor
26					long hours writing at computer (reports, emails, correspondence); meetings throughout the building and outside; phone calls
27		Thermostat does not work, office is constantly hot!	Hot	office is very busy, can't be helped	Phone calls, emails, meetings, moving around

APPENDIX B5:

Survey Response Record Sheet for Spartan Way

Open-ended Responses for:

Section 1: Functional Performance

Section 2: Indoor Environment Performance

Section 3: Participant Information

	OFFICE LAYOUT	LOCATION	AMOUNT OF SPACE
Q.	2	5	8
1	More space, windows, privacy		
2-4	No Response		
5	Window		
6	No Response		
7	Design to allow complete departments to reside alongside each other within talking / seeing distance. More occupied offices. Chat rooms wasted valuable space.	Remain fairly neutral on location. Has been removed from main office areas, but that is okay at times, as the cubicle layout(noise, disturbance) makes it hard to concentrate to write or have phone conversations.	
8	More privacy. Sound travels very easily through our work area and it is different to conduct confidential business when everyone around can hear.	Too far from copy machine and supplies too. Far from main reception area.	
9-11	No Response		
12	Curved desk area makes it hard to use keyboard. Not enough space to back up in chair. Must keep both front plus back desk at some height to use keyboard (defeats purpose).		
13	No Response		
14	Not enough desk space	Closer to all my unit people	
15	needed to be contiguous with colleagues with whom I frequently interact	Offices in a dark corner	
16-17	No Response		
18	Adequate arrangement seems like no real creative design effort expended. With some consultations the workspace could be more inspired, interesting. Look a bit more like university rather than institution. I would like to see the university being forward thinking- making staircases a center piece for first 2 floors as a option for fitness. The building is nice but unimaginative.		

Table B5.1: POE survey record sheet for Spartan Way

Table B5.1 continued: POE survey record sheet for Spartan Way

	OFFICE LAYOUT	LOCATION	AMOUNT OF SPACE
19-22	No Response		
23	Reconfigure area and build offices for system group.		This comment was omitted to maintain privacy but was included in analysis and development of recommendations.
24-25	No Response		
26		Would be closer to others in my office.	
27-28	No Response		
29			Our storage room isn't big enough- very crowded. We store the shredder bin- which everyone uses. We also store all of the toners for all the printers/copiers including Xerox. All centrally placed printers, also kitchen supplies and share with 2 other units.
30	This comment was omitted to maintain privacy but was included in analysis and development of recommendations.		I get student help twice a day- there is not space for both of us. Also, there is not enough leg room for both of us.
31	I get bored and would like the ability to rearrange the desk and other office furniture. The colors are drab and don't keep you motivated.	I think the cubicles are too small and awkward. Make Large cubicles a little bigger and put more space between the cubicle groups or just give me an office.	Workspace functions well for job responsibilities but not to conduct business conversations. A little more space/ bigger storage cabinet would be nice.
32	Need more space for storage. I have kind of high jacked rolling file cabinets from unoccupied workstations.		

Table B5.1 continued: POE survey record sheet for Spartan Way

	OFFICE LAYOUT	LOCATION	AMOUNT OF SPACE
33			We need more book shelves and file cabinet. Closet needs to be bigger and have a shelf for small personal items.
34			Need larger cubicle
35	No Response		
36	Cubicles are too close together, you can hear everything going on in other cubicles sometimes making it hard to focus		Need more storage space (drawers and bigger desk area to spread work out).
37		Need to have entire team together	
38-39	No Response		
40		Close to copier	
41-44	No Response		
45	I think such a narrow design is not conducive to efficient work or to fostering a collegial atmosphere. A copier/ printer is located at each end if you walk to one & if it's being used its about the length of a football field to go to the other one. You hardly ever see people who are housed at the ends of the offices.	This comment was omitted to maintain privacy but was included in analysis and development of recommendations.	I would very much appreciate more surface area& more drawer space. I have a lot of paper and a lot of things going on at one once. So my cube always looks like a disaster area.
46	Out of the way of noise+ passer bys.	Huge offices vs. tiny cubicles	Room to lock up secure documents
47	We do not have enough space so that everyone on our team/ unit is all together. Cubes spaced apart in different areas of building.		

Table B5.1 continued: POE survey record sheet for Spartan Way

	OFFICE LAYOUT				LOCATION		AMOUNT OF SPACE
48							Desire center desk drawer, more under desk file space
49							
50	Size of office is good but it is in a high traffic noisy area that requires door to be closed in order to focus on work. Co-workers may think I am anti social but not so. Windows clear in door would help.				Quieter location with assistant in adjoining but private office- but stadium tower does not appear to give private offices.		
51	No response						
Q.	10	12	14	17	19	21	
1-4							
5							Carpet is unraveling and has for quite sometime
6							
7							Curve of table top and placement of monitors seems to have lead to nerve issues in arm, elbow, shoulder limited by outlet plug location I assume.
8							I would prefer a desk with drawers attached.
9-10							
11							Being near a window, after many years without a window, is absolutely wonderful. However, on a bright, sunny day there is an or two when the sun shines in my eyes as there is no window shade.
12-14							
15							Not enough room for meeting with vendors. Not enough space for storage. Colors are very dull and uninviting. No work space.
16-17							
18							Poor carpet choice in one area-heels or anyone with joint problems.
19				Can't be changed			
20-21							

Table B5.1 continued: POE survey record sheet for Spartan Way

Q.	10	12	14	17	19	21
22						love the paint color in my office
23					This comment was omitted to maintain privacy but was included in analysis and development of recommendations	Hate the texture of the carpet. Tech cart does not roll well over the carpet.
24						I don't like the carpet because it is hard on the feet.
25						
26			Need to be closer.			
27	I would have the computer keyboard on a tray under the desk that could be pulled put to use.				The way the desk is set up, it makes it difficult to use the keyboard & mouse.	
28				This comment was omitted to maintain privacy but was included in analysis		

Table B5.1 continued: POE survey record sheet for Spartan Way

Q.	10	12	14	17	19	21
29				No windows- doors on our cubicles		
30				This comment was omitted to maintain privacy but was included in analysis		
31			You hear everything everybody says. You shouldn't have to leave your office to have a private conversation. Higher cubicle walls please.	If we must be in cubicles, can the walls be higher and how about a door, they do make them for cubes.	It works; it's just ugly- make a better color selection.	Change color scheme
32				This comment was omitted to maintain privacy but was included in analysis		
33	Too close and too noisy. White noise is not the answer.			Close off the windows between cubicles. Have a door to close. Walls that go to the ceiling would be really nice.		Chairs do not roll without major effort because of bumpy patterned carpet. Colors are drab and patterns are ridiculous. Work surface corners are sharp or edged with hand rounded pieces not good for computer use.

Table B5.1 continued: POE survey record sheet for Spartan Way

Q.	10	12	14	17	19	21
34-35						
36				Make the cubicles less out in the open		
37			Need to be closer to co-workers			
38-44						
45			The very long hallway type design isolates people. Also, there is always a feeling of people listening to your conversations because we are so close together.	I would like the opening of my cube not to face the window of the office opposite.	Keyboards should be in ledges that are height adjustable.	Too much money was spent on the décor of our office, considering this is a university. Why do we need sculpted carpets or marble topped conference tables, those ridiculous round things on the top of the cabinets? When we moved in here, there was such a sense of office being way more important than the people in it. Plus the design of the bathroom sink area is horrible. There's standing water on the counter constantly-sometimes so bad, it is dripping on the floor.
46		Privacy	Privacy	used to an office		Uneven carpet pattern make lunch room less noisy
47			Have to do a lot of walking			Put padding under carpet; pick a smoother carpet that vacuum easily.

Table B5.1 continued: POE survey record sheet for Spartan Way

Q.	10	12	14	17	19	21
48-49						
50			People just need to get up& walk to see co-workers. My assistant could be closer to my office in an ideal situation. Would like window in door so door can be closed but I still appear sociable and accessible.	see #15	Brought our own furniture	Could use carpet cleaning overall & stain removal
51			It would be nice to be in an area all together, where we can interact without worrying about disturbing others around us.	A door		
	OFFICE EQUIPMENT		ACCESSIBILITY	PERSONAL CONTROL	WINDOW LOCATION & VIEW	
	23		25	27	30	
1						
2	Copier and printer is always breaking down.			We have no control on temperature of office, so therefore it can be too cold or too warm at times.	I wouldn't mind having some kind of window covering to prevent sun from causing computer glare at certain times of the year.	
3	Copiers require assistance from IT- but because it didn't help procure copier they are unable to service/ assist			I need to purchase a heater (my own) I seem to be cold most days		
4						
5	Phone system seem cumbersome					

Table B5.1 continued: POE survey record sheet for Spartan Way

Q.	23	25	27	30
6	Would like printer at each work station			
7	Phone system. Phone tree-answering ability from other locations when ringing. Seems to have a lot of maintenance issues. Printers, copiers- jamming, breaking, overloading server- not sure how to fix.		I don't believe we have any control. Especially in cubicles. I have a fan- but limited power outlets.	Very few cubicles. If the windows could open in fresh air. Cubicles positioned in a manner as not to "see" out window. Ventilation in this building is horrible.
8	Printers that don't breakdown at crucial times.			
9			I have no control usually too hot in summer.	
10	The document centers fax, print & copy all in one machine. If someone has sent a huge print job & you need to copy- you are waiting forever.	The main entrance is totally on the opposite side if where I sit.	Temp is either freezing or hot- it is very hard to control.	
11		It is a long walk from parking lot and up a lot of steps. It is okay for a young healthy person but could be difficult for an old or injured person.	My desk is small and having the computer box under my desk is not very handy. Chair needs replacing- cushion packed down. An ergonomic evaluation would help.	It is a blessing most of the time I feel very fortunate to be near a window.

Table B5.1 continued: POE survey record sheet for Spartan Way

	23	25	27	30
12			There is no control for heating and ventilation, even if we all agree we are hot, we can't change the thermostat.	
13				
14	Would love to have a printer at my desk		This comment was omitted to maintain privacy but was included in analysis and development of recommendations	
15			Always too hot in winter likewise in summer. No personal control is available.	
16			Cooling and heating are not constant.	No blinds- late afternoon sun obscures the computer monitor images.
17				
18	It would be nice to be able to pick up phone@ any desk in the area. Pick up has long been an option in office.		Only problem is temp. Personal heaters are a must.	
19	Always busy		Way too hot	
20				
21				
22			I am always a warm person some days it is freezing in my office	
23				Get a window.
24	The printer is always jamming and breaking down		Very little control over HVAC. Still get food smells in building	Windows are near enough to work station.

Table B5.1 continued: POE survey record sheet for Spartan Way

25	It is okay that we have a group copier in a central location. I understand why and as a side it gives me some exercise nut when you have a bog job, lose time and lots of problems, the central copier doesn't work well.		I think temperature control during the workday is ok. If one is working on a pressing project after 5pm or on the weeks, the temperature creeps up. In the summer, the temperature would regularly hit 90 degree.	
26	We need a more efficient copier/printer. Does not like to do large jobs and if it does work without jamming it is too slow.			Only problem is during fall, sun hits my desk computer; viewing is difficult in the afternoon.
27-28				
29				There is very little that can be done.
30			This comment was omitted to maintain privacy but was included in analysis	Other than being cold in the winter, I am very OK. I have two double glass doors to the patio.
31	I would make the temperature higher but this is something that no one will ever be happy with someone is always cold someone else hot.			

Table B5.1 continued: POE survey record sheet for Spartan Way

	23	25	27	30
32	This comment was omitted to maintain privacy but was included in analysis and development of recommendations	Due to higher than usual security within our building, I am ok as I have my ID on me before 7:45 am or after 5:00pm	We constantly have heating/ cooling issues	Is it not a window to the outdoors but that's okay.
33			Generally too cold all year round. Need to use power strips because outlets are not close enough to computer equipment.	Window looks into cubicles on either side of me.
34-35				
36	This comment was omitted to maintain privacy but was included in analysis and development of recommendations			
37	Need more space at monitor location, have to get up to file most things.			
38-39				
40				I would like to be able to see a window.
41	I wish we had personal printers in our offices.			
42				
43			Temperature can be too variable, ventilation/ air flow from catering downstairs is terrible.	I have no view from my office to a window

Table B5.1 continued: POE survey record sheet for Spartan Way

	23	25	27	30
44	Our printers commonly have problems and the other printer that we can use is all the way down on the south end of the building.		There is only one outlet to use besides my computer outlet.	
45	I very much appreciated my computer double screens. I really dislike the printer copiers. I have to frequently make a small set of copies and often have to wait for print jobs coming through as a copy did the one dedicated to the copier.		I have no say in any of these.	
46		Very windy plus cold in front of building. Also sun reflection from building blinding.	Sometimes too hot, sometimes too cold. Horrid fumes from kitchen below.	Face it
47	Too far to go to make a copy and took a year but finally got us a printer in our area.		There is no ventilation in the women's restroom, always smells, always cold, blowers always blowing cold air down on you. Can always smell what they are cooking in the kitchen.	

Table B5.1 continued: POE survey record sheet for Spartan Way

	23	25	27	30
48			Heating/ cooling controls regulate 3 offices. One office is freezing while 3rd office is boiling hot and vent over desk is very drafty.	
50	Need a higher quality printer, Need upgraded computer-grinding noise, have been told by IT that my computer is dying-might crash.		No control of temp & ventilation. Personal office thermostat would be great.	Windows for offices would be great but I understand it was more important to give natural light and windows to those workers in cubicles- this seems fair. Absence of window affects my overall satisfaction.
51			I am always cold regardless of season. Cannot regulate	We don't have windows that open. Its forced air.
	INCORPORATION OF USER NEEDS			
	37	44	49	
1				
2	We were not given an opportunity to provide input. Ladies restroom location not convenient or adequate. Always better to work in better surroundings.			
3				This comment was omitted to maintain privacy but was included in analysis and development of recommendations
4				
5	Sure			
6			Desk fluorescent lighting	

Table B5.1 continued: POE survey record sheet for Spartan Way

INCORPORATION OF USER NEEDS			
	37	44	49
7	I am not sure the needs of employees were considered at all. Functionality of location, storage, counter space for project meetings. Office numbers- tiers of who deserved one-all call short.	Make natural light available to more workspaces so as not to be operating in a cave like storage closet like a cube more control of light in personal space.	Circulate the stale stagnant air. Allow for cooler temperatures
8		It would help if curtains were on the windows to block out the late afternoon sun.	It's always too cold
9			I don't like not having some control of my workspace temp.
10	No- we were not shown the layout & that was it opinions were not considered.	Place in some warmer colored lighting. Way too much glare everywhere.	
11	Operable windows		Add humidity in the winter. Humidity is lower than 20% or less. A little more heat would help in cool weather.
12	Direction before Q32 not worded correctly. No. I am not located near co-workers in my department. There is no work area close to us. Q 38- option 5- negative effect on performance	I would like natural light	Ventilation is poor and there is no control over temp, so would like change these.
13			Smells from cooking upstairs
14	No work space, not enough room to work efficiently.		It is always freezing

Table B5.1 continued: POE survey record sheet for Spartan Way

	INCORPORATION OF USER NEEDS		
	37	44	49
15	The work of my team is fundamentally different than that of all others in the unit. Our needs did not seem to be considered or understood. I wasn't in the unit prior to renovations.		Too hot in winter and summer. Very dry.
16			
17	Restrooms are very bad; water comes out of wash basin.		
18	No. Not really. The space is pretty generic.		No control over temp & ventilation. I just keep a sweater and try to dress in layers but the thermostats area joke.
19		Overhead lighting too bright	Always too hot winter or summer
20	I have no idea what renovations occurred. If this is about Spartan way, then my major concern is the terrible acoustics in the café lounge.		
21	Yes, generally speaking		
22		More lamps, overall lights are too bright	
23	Nope. We need offices.		This comment was omitted to maintain privacy but was included in analysis
24			Often too hot. The ventilation makes a lot of noise- vibration of vents.
25			
26	Area was designed, no inputs were needed.		Sometimes too hot others too cold.
27			
28			If there is a problem it is resolved very quickly.
29	Yes		

Table B5.1 continued: POE survey record sheet for Spartan Way

	INCORPORATION OF USER NEEDS		
	37	44	49
30	No-space/ location of mail room		
31		I would prefer more natural light	Less noisy ventilation system
32			
33	No. Privacy issues, noise levels and layout of computer were all ignored.		Almost always too cold no matter what time of year. Move the blower event away from me.
34		Too bright	Everyone around can hear everything and I am saying that I can hear everyone else.
35			
36	How much storage space is needed?		
37	No- open workspaces were not provided. Also, employees lost private offices.		
38			
39			Its either too hot or too cold
40			Warmer please.
41			
42	yes		
43		More natural light.	
44	yes	Many employees in the people find the overhead lights to be uncomfortable and glaring. Many have resorted to lamps.	The air conditioning can be too cold and I feel it is a waste of energy.
45	There no privacy, the work area is too small, the lighting is too bright. We in cubes could use the chat rooms when we need a bit of privacy. However the chat rooms have long ago been converted to offices.	It's too bright but because we are in cubes, it can't be modified for individuals.	It s almost always too warm for me.

Table B5.1 continued: POE survey record sheet for Spartan Way

INCORPORATION OF USER NEEDS			
	37	44	49
46	Privacy		Eyes burn every day. Too hot one day, too cold the next.
47	Construction quality is terrible. Floors not level, water leaks in building from rain cabinets came off walls. Use of all plugs at same time in kitchen came off; doors not hung properly, bathroom sinks countertops not functional but looks pretty! Paper towel dispensers don't work; Handles broke off sinks already. Big crack in entrance wall near second floor.		Dry- eyes burn. You can smell what they are cooking in the kitchen. Change the way the air blows down, diffuse and make it warm air. Don't blow down on you.
48	The creation of two types of cubicles based on employee classification was not a good idea.	There is too much fluorescent lighting	
50	In my previous office I had complete control over renovations and furniture design and layout.	No natural lighting in offices. Have lighting professional look at desk/ computer layout and make recommendations for proper overhead lighting.	Can be hot, seems dry, exhaust fumes come into private office- difficult when it happens due to asthma. Individual office controls for heating and cooling
51			It's very dry and I am usually cold
		ACOUSTIC	
	52	55	68
1			Long hours at keyboard/ computer, long work to file room, long walk to copier.
2	We tend to receive kitchen odors when they prepare food in stadium.	Sometimes difficult when others are having conversations.	

Table B5.1 continued: POE survey record sheet for Spartan Way

		ACOUSTIC	
	52	55	68
3		You can hear every conversation in the office unless you are in one of the closed offices-	Telephone calls- copier, computer data entry in adv-access preparing mailings for travel tours away game tailgates or other program events.
4			Frequent telephone conversations, email 200+/ day, Engagement with personnel, Reviewing document.
5			
6			Telephone conversations, proof reading, work on computer monitor, printing letter and envelopes
7	Figure out where the ventilation is piped. Kitchen and bathroom odors are very prominent. Air does not seem to circulate well.	Any change that would help sound privacy. Phone conversations are impossible. Therefore, one has to leave workspace to go to a chat room- what if we need computer for conversations.	Long hours of reading and researching. Frequent phone calls to university units. Long hours of computer work. Analysis. Meetings.
8		Everyone can hear everything you say	Writing, reading, telephone conversations, gathering items for events, computer work
9			Telephone, reading, researching on computer, proposal writing.
10			Frequent movement, long computer hours
11	Air purifier to remove dust would help. Some of us developed eye allergies. Being able to open windows in nice weather. More custodial service staff.		All of the mentioned, computer work, some files still on paper, meetings, computer intensive work.

Table B5.1 continued: POE survey record sheet for Spartan Way

		ACOUSTIC	
	52	55	68
12	Better ventilation	There is little privacy. I can hear others conversations so I am sure they can hear mine.	Many hours of reading and editing, numerous phone conversations, many hours of computer usage-creating documents, websites, using email, etc. Brain storming with co-workers about projects. Visiting with vendors regarding project details.
13			All mentioned + many hours on computer
14		Everyone is so close together, you can hear everything going on in all offices/ cubicles around your area.	
15		It is not possible to professionally interview donors in an open space. Yet it is also not possible to interact with colleagues in order to consult on projects (disturbs others)	Writing, lengthy phone conversations, visitors/ vendors coming by, need to interact with colleagues, need to spread out materials.
16			Meeting with others, printing materials.
17			Telephone conversations, Looking a lot into computer screen, discussion with team members.
18		Too close to other staff members.	Hours at terminal, movement to meetings-samefloor-1-2 hours each, UP & down to collect printed materials. Minimum if 1 hour/ day reading printed materials, frequent interactions one on one- quite so don't disturb others.
19		To loud once, two or three people are on the phone. You can't hear your own call. Always hear everyone else's conversation (phone/ person)	Phone, computer, paperwork, meetings throughout building.

Table B5.1 continued: POE survey record sheet for Spartan Way

		ACOUSTIC	
	52	55	68
20			Word processing, emailing, meeting with other departments across campus, research and other reading, walking to think.
21			Technical assistance (phone & other offices), meetings (various projects), server management, attend department events, attend training.
22			phone, internet, email, travel, meetings
23	We get exhaust fumes, kitchen smells 2-3 times a week.	This white noise thing is ridiculous, so noisy.	Answer phone helpdesk. Take classes. Read. General knowledge improvement. Talk to others on phone. Heads down deep thought work, power shell, active directory, some coding.
24	The air quality in the bathroom on the third floor is terrible. It always smells bad. It smells like sewer back up air. This has been bad since day 1. Nothing seems to make it better.	Do not like the white noise machine. It needs to be turned down. It is not necessary.	Computer works, phone work, assembling meeting material, training in conference room, introducing new staff- take them around the building.
25			
26		White noise is too loud. This can be adjusted for areas with special controls. Does not have to be set the same for the whole building.	Computer work - 60% Meeting people - 5-10% Phone conversations - 10%.
27		You can hear everything that is said in each cubicle.	Numerous telephone conversation (some confidential), Meeting with folks in my area, reading for accuracy of documents.

Table B5.1 continued: POE survey record sheet for Spartan Way

		ACOUSTIC	
	52	55	68
28		Everything echoes. You can hear conversations from down the hall & around the corner. Very hard to concentrate because of the noise. We were told we would have the state of the art noise reduction system- it doesn't work.	Phone conversations, balancing monies received, processing credit cards transactions, depositing checks.
29		No sound privacy	
30			
31		You can hear everyone else's conversations and all other noises	Numerous telephone conversations, coding data manipulation website updates, meetings with end users/ managers, website design, trouble shooting PC problems/ help desk.
32	Whenever they grill down in catering (first floor), we get the smells up here. This is bothersome to a couple of our staff members.		Frequent movement within different areas and floors of building, meetings within various offices on second and third floor, phone conversations (open and closed door), full face private conversations, several hours at desk in front of computer.
33	At times we have cooking odors and a smoky haze hangs in the air.	White noise is not covering the noise from co-workers and turning the white noise up has resulted in feeling like your working in an airplane all day.	Long hours of computer work, data analysis, and limited phone conversations some interactions with co-workers, to many meetings. Majority of activities require quite uninterrupted concentration.
34			Telephone conversations, computer work.
35			Computer data entry/ assisting others going to their areas, using various tools for looking up data both in books on shelves & computer.

Table B5.1 continued: POE survey record sheet for Spartan Way

		ACOUSTIC	
	52	55	68
36		Cubicles are too close together- can hear everything going on around you.	Computer work, filing, telephone use, lots of reading, lots of typing.
37			Attend meetings, work on computer, make phone calls, most meetings in office.
38			
39			Numerous meetings within building. Numerous phone conversations. Many hours on computer.
40			
41	We often smell the caterers downstairs		Managing people, email, computer work, letter composition, numerous telephone conversations
42			
43	Venting from catering, restroom ventilation.		
44	Horrible odor in the restroom at times. Sewage odor.		Numerous phone conversations, meetings in office, meetings in conference rooms, tours of building, long hours of research.
45	The first year or so, the odors from catering downstairs were almost a daily occurrence- sometimes we would actually see a haze in the air. This has been corrected and now there are only occasional aromatic days. Some days it is very humid and stuffy in here.	Not only can all hear other people's conversations but mine are heard by others. As much as I do not like my office environment, but I do not let it affect my work.	Hours of auditing vouchers and reports, Frequent trips to copier, numerous phone conversations, long hours of looking at computer monitor- spreadsheets, reports, etc., Answering lot of questions from colleagues and donors.

Table B5.1 continued: POE survey record sheet for Spartan Way

		ACOUSTIC	
	52	55	68
46	Fumes from kitchen still come unto floor. Eyes burn.	Can hear everything in area- voices, etc.	On computer.
47	Vent outside and have intake outtake apart from each other. Cold air returns.	White noise helps café lounge echoes too much. If your fingers are frozen you can't type.	Frequently go between floors and walks to copy areas long hours on computer, long desk hours.
48			Extensive computer work, telephone donor calls, walking to second, travel up & down 3rd floor to meetings
50	Smoke fumes and exhaust fumes come into private office spaces, find out why and where smoke and exhaust fumes are entering system in spelling out in office space.	Office size is wonderful but in high traffic area so need to close door. Windows (clear) in door would be good. Then I appear sociable accessible but can get down on high traffic noise. To work productivity and to be able to concentrate & focus, I need to shut door to shut out noise.	Researching, writing, editing, interviewing, hiring staff/ faculty, communicating with staff donors, on & off campus partners, customers & public. Interviewing face to face hiring faculty instructors, staff for evening college courses, curriculum development, researching, reading, email and phone communication with faculty and vendors and donors& off-campus partners, customers, registered students & public and colleagues.
51		This comment was omitted to maintain privacy but was included in analysis and development of recommendations	

APPENDIX B6:

Survey Feedback Section Comparative Analysis Sheet

S.P.D.C. and Spartan Way Responses Combined

	1	2	3	4	5	6	7	8
	For mat	Appro priaten ess	open- ended	Survey	Focus Group	Covera ge Extent	Right Questi ons	If No, What Questions
1	1	1	3	2	2	2	1	1
2	3	3	3	2	4	2	1	1
3			3	2	3	1	1	
4	2	2	3	2	2	1	1	
5	2	2	3	1	6	2	1	
6	6	4	1	1&2; no intervi ews	1	3		
7	1	1		1	3	2	1	1
8	2	2	3	2	2	2	1	
9	2	2	3	2	1	1	1	
10	3	3	3	2+3	4	1	1	
11	4	4	3	1	6	2	1	Ask about overall staffing concept
12	4	4		1	2	2		Social interaction questions missing
13	1	1	3	1	2	1	1	
14	3	2		1	3	1	1	Ask us about teaching, studios & computer lab space
15	4	3	3	1+4	Why would I be satisfied about it? If you are asking if I would volunteer for it- Yes.	1	1	Consider flexibility of the space for use in future.

Table B6.1: Survey Feedback Section Comparative Analysis Sheet for S.P.D.C. and Spartan Way (combined)

**Table B6.1 continued: Survey Feedback Section Comparative Analysis
Sheet for S.P.D.C. and Spartan Way (combined)**

	1	2	3	4	5	6	7	8
	Format	App propr iate ness	open- ended	Survey	Focus Group	Cover age Extent	Right Questions	If No, What Question s
16	6	5		2	2	3	3	Too many questions require uninform ed opinion
17	4	3	3	2	2	2	1	
18	2	2	3	3	1	1		
19	1	1	3	1	4	2	1	
20	2	1	3	2	2	1	1	
21	1	1	3	1	3	1	1	1
22	1	3	3	2	3	2	1	
23	1	1	3	1	1	1	1	
24	4	4	3	2	5	2	1	1
25	3	3	3	2	3	3	1	
26	2	2	3	2	3	1	1	
27	2	3	1	2	1	1		Process questions related to how they selected their space and work
28	3	2	4	2	1	1		

**Table B6.1 continued: Survey Feedback Section Comparative Analysis
Sheet for S.P.D.C. and Spartan Way (combined)**

	1	2	3	4	5	6	7	8
	Format	Appropriate ness	open- ended	Survey	Focus Group	Coverage Extent	Right Quest ions	If No, What Questions
1				2	2	2		
2	3	3	1	2	3	2	0	
3	5	4		2		3		Space issues, good use of current locations etc.
4	3	4	2	2	1	4		Not sure what overall objectives
5	2	2	3	1	2	1	1	
6	6	4	2	1	4	3	1	
7	2	2	3	2	2	2	1	
8	3	2	1	2	2	2	1	
9	2	2	3	2+3	1	1	1	
10	3	2	3	1	2	1	1	
11	1	1	3	2	4	2		Need additional questions. Layout of units, accessibility to conference rooms
12	2	2	3	1	4	2	1	
13	6	2	3	2	4	2	1	
14	4	4	3	2	4	2	1	
15	3	3	1	2	3	2	2	What we need? How we work best? What type of environment do we work best in?

**Table B6.1 continued: Survey Feedback Section Comparative Analysis
Sheet for S.P.D.C. and Spartan Way (combined)**

	1	2	3	4	5	6	7	8
	Format	Appropriate ness	open- ended	Survey Method	Focus Group	Cover age Extent	Right Questio ns	If No, What Questions ?
16	5	5	1	2	4	2	0	Desk suitability
17	3	3	3	3	3	2		
18	6	6	1	1	6	2	1	
19	3	3			3	1		
20	2	2	3	3		1	1	
21	2	2	3	1+2+3	2	2		
22	2	2	3	2	2	1	1	
23	3	3	1	2	2	1	1	
24	1	1	3	2	2	2	1	
25	4	3		2	4	2	1	
26	1	1	3	2	1	1	1	
27								
28	2	1	3	2	1	2	1	
29	2	2		2	6	1	1	
30	4	4	3	1	4	2	1	
31	2	2	3	2	2	2	1	
32	3	3	3	1	1	4	1	
33	2	2	3	1	4	1	1	
34			How will we know the outcom e of the surveys?	2	1		1	
35				4- survey too long				
36	2	2	3	2	3	1	1	
37	1	1	3	2	1	1	1	
38	4	4	1	1	2	1	1	
39	4			2	2			
40	2	2	3	2	4	2	1	
41	4	2	3	2	4	1	1	

**Table B6.1 continued: Survey Feedback Section Comparative Analysis
Sheet for S.P.D.C. and Spartan Way (combined)**

	1	2	3	4	5	6	7	8
	Forma t	Appro priate ness	open- ended	Survey Method	Focu s Grou p	Coverage Extent	Rig ht Qu esti ons	If No, What Questions?
42	3	2	3	2	3	1	1	
43	2	2	3	3	5	2	1	
44								
45	6	6	1	2	5	2	1	
46	4	1	3	2	1	2	1	
47	1	1	3	2	3	1	1	
48	4	3		2	2	2		
49	2	3	3	2	6	2	1	
50	4	4	3	2	3	1		
51	2	2	3	2	4	1	1	
52	4	4	3	2	4	1	1	
53	4	4		1	3	2		
54	1	1	3	2	7	1	1	
55	2	2	3	2	7	2	2	
	9	9-other	10	11	12			
	Effectiven ess of Survey		Missing Aspects	Unclear & Confusing Questions	Unnecessary Questions			
1-2								
3	1							
4	1							
5-7								
8	1		NA	NA	NA			
9	1							
10	1							

**Table B6.1 continued: Survey Feedback Section Comparative Analysis
Sheet for S.P.D.C. and Spartan Way (combined)**

11		Sort of	Space satisfaction is closely related to overall management and job duties- more questions about this.	The use of "satisfaction" phrase is vague to me. It does not capture my feelings- although there is plenty of opportunity- to relate concern in the open ended portion	Ask questions that ask about what uses like about things. All questions encourage respondents to find faults. Ask about overall satisfaction with renovation process
12		More or less			
13	1				
14	1				67 part 2
15	In between yes and no	For IEQ purposes- yes. Use of common spaces, lunch room, etc. meeting rooms with students on each floor.	The workspace overall is not fully encouraging for interaction. It does not provide full privacy when needed. The building does not give common study areas to students or faculty.		13
16	0	fourth floor			too many
17	1			The scale generally starts from very dissatisfied to satisfy in the survey!	47 and 51 as same question
18					
19	1				
20					

**Table B6.1 continued: Survey Feedback Section Comparative Analysis
Sheet for S.P.D.C. and Spartan Way (combined)**

	9	9-other	10	11	12
	Effectiveness of Survey		Missing Aspects	Unclear & Confusing Questions	Unnecessary Questions
21					
22					
23	1				
24					
25	1				
26	1			Need NA option.	
27					
28					
1	0	Common areas, bathrooms			
2	0				
3	In between yes and no.	Ladies restroom needs much attention - in terms of location, number of stall, odor etc.			
4	1		It seems that the same questions were asked but in different uses of verbiage	age	
5	1				
6	1				
7	1				
8					
9	1		Q31 I couldn't quite figure out what you were asking		
10	1	My only concern is temp, bathrooms on the second floor. During summer, it is very hot. No air is circulated at all.			

**Table B6.1 continued: Survey Feedback Section Comparative Analysis
Sheet for S.P.D.C. and Spartan Way (combined)**

	9	9-other	10	11	12
	Effectiv eness of Survey		Missing Aspects	Unclear & Confusing Questions	Unnecessa ry Questions
11	1	We do not have enough large conference rooms to use. We end up having meeting off-site, therefore, spending additional funds.			
12	1	Access to building (from parking lot #79) and restrooms is not good for persons with walking disability. The second floor break room is not cleaned or maintained very well.			
13	1		After Q31, 32, the italicized text doesn't tell you what to do if you have no previous office space.		This survey took longer than stated and I did not take any calls during this time.
14	1				
15	1				
16	0	I completed the survey based on workspace I was originally assigned. I moved six months ago into another space being adequate for the teams needs.	Q28 should state- "if NO, skip to Q7 which is on page 4, but not numbered. Q36- NA if not long-term employee of unit, likewise for Q38. Q56 needs likert scale. #58-60 also NA to new employees	#50-52, #24-25, #58-60	

**Table B6.1 continued: Survey Feedback Section Comparative Analysis
Sheet for S.P.D.C. and Spartan Way (combined)**

	9	9-other	10	11	12
	Effectiv eness of Survey		Missing Aspects	Unclear & Confusing Questions	Unnecessa ry Questions
17	1				
18	1	Restrooms, café lounge, cleanliness.			
19					
20	1				
21					
22	1				
23	1				
24	1				
25	1				
26	1				
27					
28	1				
29	1	Does not include ease of restroom facilities, which this building is not good. So far from workplace.	On 58-61, not sure if you meant HVAC or computer technology.		
30	1				
31	1				
32					
33	1				
34	1				
35					
36	1				
37	1				
38	1	Building security. Inability to feel safe in a cubicle environment during night and weekend work when building is mostly empty.	Questions refer to renovations- this was a new building. Q58-60- not sure what is meant by new technology.		
39					
40	1				

**Table B6.1 continued: Survey Feedback Section Comparative Analysis
Sheet for S.P.D.C. and Spartan Way (combined)**

	9	9-other	10	11	12
	Effective ness of Survey		Missing Aspects	Unclear & Confusing Questions	Unnecessa ry Questions
41	1				
42	1				
43	2	More regarding privacy (noise level in cubicle environment)			
44		Restrooms, cleanliness, kitchen facilities and how it supports staff who bring lunches, lighting in common areas.			
45	0				
46	1	There should have been bathrooms at both ends of third floor. They are too far away.			
47	1				
48					
49	1			The instructions after question 31 and 32	
50	1	This office is poorly laid out. I think it is odd that this place was designed with so many cubes/ designated for people who are not fundraisers nor supervisors & so few offices. We have areas with many empty cubes & then areas where we can't even have all the staff of the unit together. I also think its odd that so many small conference rooms were designed without having one large one. We have to spend money every time we have a meeting with more than maybe 1 people to rent other facilities. Quite ridiculous for a unit as large as ours.			

**Table B6.1 continued: Survey Feedback Section Comparative Analysis
Sheet for S.P.D.C. and Spartan Way (combined)**

	9	9-other	10	11	12
	Effectiveness of Survey		Missing Aspects	Unclear & Confusing Questions	Unnecessary Questions
51	1	You have covered them.			
52	1				
53	0				
54		The building is new- it would cost a tremendous amount of money to implement changes for best comfort and work style of workers. If the office design changes are to be made, workers from all levels need to be included not just the leadership teams.			
55					

APPENDIX B7:

Modified Final POE Questionnaire

Post Occupancy Evaluation Building Occupant Survey

The purpose of this survey is to assess your level of satisfaction with regard to the functional and indoor environment performance of your personal workspace and capture your recommendations to all things that you would like changed such that you are satisfied with your personal workspace.

Please record your start and end time for completing the survey:

Start time: _____ End time: _____

Section 1: Occupant Satisfaction with regard to Functional Performance

Please note: Functional performance refers to the performance of the design components of your workspace towards your task performance.

On a scale of 1 to 7, where 1=very satisfied, 2=satisfied, 3=slightly satisfied, 4=neutral, 5=slightly dissatisfied, 6=dissatisfied and 7=very dissatisfied, please indicate your level of satisfaction with regard to the following aspects:

1. How satisfied are you with your **office layout** i.e. the placement of your workspace/ cubicle/ rooms with regard to your surrounding workspaces/ cubicles/ rooms?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

2. How satisfied are you with the **location of your personal workspace** in relation to the remaining office area?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

3. How satisfied are you with the **amount of space** available for individual work and storage?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

4. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

5. Does your personal work space function well for your job responsibilities?
- Yes
 - No
 - Not applicable

6. If your answer is No, please explain why?

7. Does your personal workspace work well for your work performance?
- Yes
 - No
 - Not applicable

8. If your answer is No, please explain why?

9. Does your overall building work well for your work performance?
- Yes
 - No
 - Not applicable

10. If your answer is No, please explain why.

11. How satisfied are you with the **ease of interaction** with co-workers?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

12. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

13. How satisfied are you with the **overall privacy** of your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

14. How satisfied are you with the **visual privacy** of your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

15. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

16. How satisfied are you with your **office furniture** in terms of comfort, flexibility, sufficiency, overall appearance?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

17. How satisfied are you with your **office furnishings** (for e.g. carpet or curtain color, finish, function, overall appearance)?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

18. How satisfied are you with your **office equipment and their contribution to your task performance?** (For example: printer, phone, fax machines, computer accessories, etc)

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

19. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

20. How satisfied are you with the ease of **accessibility** to your personal work space from the entrance of your building?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

21. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

22. How satisfied are you with the **access and ability of personal control** in your workspace for heating, ventilation, connection points, and power supply stability?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

23. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

24. Do you have a window in your personal workspace?

- ☐ Yes
- ☐ No
- ☐ Not Applicable

25. If yes, how satisfied are you with your **window location and view**?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

- a. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

26. If No, to what extent does absence of window affect your overall satisfaction with your personal workspace?

- ☐ To great extent
- ☐ To some extent
- ☐ To little extent
- ☐ Not at all
- ☐ Makes it worse

27. How satisfied are you with your **current personal workspace**?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

28. How satisfied are you with your overall **building renovation/new construction**?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

29. How satisfied are/were you with the **process of renovation/new construction**?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

30. How satisfied are you with the **construction quality** (example: product finishes, installations of hardware, etc) of your building after renovation/construction?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

31. How satisfied are you with your **overall workplace environment**?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

32. To what extent do you consider that your needs were incorporated into the design of your workspace?

- To great extent
- To some extent
- To little extent
- Not at all

a. If 'to a little extent/not at all', what was omitted?

33. How has the renovations affected your work performance?

- Great improvement
- Moderate improvement
- Little improvement
- No affect
- Made it worse

34. Other aspects that may affect your overall level of satisfaction or dissatisfaction with your workspace may be the organization structure of your department or your changed job-description.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

Section 2: Occupant Satisfaction with regard to Indoor Environment Quality:

Please note: Indoor environment refers to the overall feel and quality of the space inside your office.

On a scale of 1 to 7, where 1=very satisfied, 2=satisfied, 3=slightly satisfied, 4=neutral, 5=slightly dissatisfied, 6=dissatisfied and 7=very dissatisfied, please indicate your level of satisfaction with regard to the following aspects:

LIGHT

35. How satisfied are you with the **natural lighting** at your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

36. How satisfied are you with the **artificial lighting** at your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

37. How satisfied are you with the **visual comfort of the lighting** at your workspace (e.g. glare, reflections, and contrast)?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

38. How satisfied do you feel with the **overall lighting comfort** at your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

39. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

THERMAL COMFORT

40. How satisfied are you with the **temperature** in your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

41. How satisfied are you with the **humidity** in your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

42. How satisfied are you with the **ventilation** in your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

43. How satisfied are you with the **overall thermal comfort** of your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

44. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

AIR QUALITY

45. How satisfied are you with the **air quality** at your workspace (stuffy/stale air, cleanliness, odors)?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

46. How satisfied do you feel with the **ventilation** of your office?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

47. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

ACOUSTIC

48. How satisfied are you with the **noise level** of your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

49. How satisfied are you with the **sound privacy** of your workspace?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

50. If you are satisfied or dissatisfied, please explain why. If you may be dissatisfied what would you change?

51. Do you think that the overall indoor environment of your workspace affects your work performance and productivity?

- ☐ Yes
- ☐ No
- ☐ Not applicable

52. To what extent do you think that indoor environment affects work performance and productivity?

- ☐ To great extent
- ☐ To some extent
- ☐ To little extent
- ☐ Not at all

53. Was there any new computer or HVAC related technology implemented in your building?

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ Not applicable

54. If yes, how satisfied are you with the implemented technology?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

55. Was there any other kind of new technology implemented in your building?

- ☐ Yes
- ☐ No
- ☐ Do not know
- ☐ Not applicable

56. If yes, how satisfied are you with the implemented technology?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

57. If you are satisfied or dissatisfied about any new technology implemented in your building, please explain why. If you may be dissatisfied what would you change?

Section 3: General Information

58. How long have you been working in this building? Please indicate your answer in number of years.

59. How long have you been working at your *current* personal work space (open workspace/ cubicle/ cabin/ office area)? Please indicate your answer in number of months/ years.

60. In a typical week, how many hours do you spend in your personal workspace? Please indicate your answer in number of hours/week.

61. Which of the following best describes your personal workspace?

- ☐ Enclosed office, private
- ☐ Enclosed office, shared with other people
- ☐ Cubicles with high partitions (about five or more feet high)
- ☐ Cubicles with low partitions (lower than five feet high)
- ☐ Workspace in open office with no partitions (just desks)
- ☐ Other, please specify

62. What is your gender?

63. Please indicate your age in number of years below.

64. How would you describe the work you do? Please select all options that apply to you.

- ☐ Administrative
- ☐ Staff
- ☐ Technical
- ☐ Professional/ Faculty
- ☐ Other, please specify

65. Please list at least five activities that may be part of your role and responsibility. For example, frequent movement within different areas and levels of the building, numerous telephone conversations, and long hours of reading).

Section 4: Post Occupancy Evaluation Survey Evaluation

1. How satisfied are you with the format of the survey?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

2. How satisfied are you with the appropriateness of the questions?

Very dissatisfied ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very satisfied

3. Please comment on the balance of open ended to closed response questions.

- ☐ Need more open-ended
- ☐ Need fewer open-ended
- ☐ Just right for me

4. In the future, which method of interaction would you prefer for this kind of study?

- ☐ Paper-based (similar to this one)
- ☐ Web-based
- ☐ Interviews
- ☐ Any other? Please specify _____

- 5. Would you prefer if these questions were being asked in a focus group containing persons from adjacent workspaces instead of this survey?**
- ☐ Yes
 - ☐ No
 - ☐ May be
 - ☐ Do not know
 - ☐ Not applicable
- 6. Would you prefer if these questions were being asked in an interview setting instead of this survey?**
- ☐ Yes
 - ☐ No
 - ☐ May be
 - ☐ Do not know
 - ☐ Not applicable
- 7. In your opinion, to what extent did the survey cover aspects that you would like to comment upon about your office?**
- ☐ To great extent
 - ☐ To some extent
 - ☐ To little extent
 - ☐ Not at all
- 8. To what extent do you think that right questions are being asked of building occupants?**
- ☐ To great extent
 - ☐ To some extent
 - ☐ To little extent
 - ☐ Not at all
- 9. If 'To a little extent/not at all', what questions should be asked?**
- 10. To what extent do you think that the survey allows you to effectively indicate your satisfaction with the design of your workspace?**
- ☐ To great extent
 - ☐ To some extent
 - ☐ To little extent
 - ☐ Not at all

11. Please mention any aspects that may not have been included for evaluation of your satisfaction but which may be representative of performance of your workspace function and environment in your opinion.

12. Please list by number any questions that you find unclear, confusing, and unnecessary. Please explain why.

We request you to go back to the start of the survey and enter the 'end time' of the survey before sending this.

Thank you for your participation in this survey!

APPENDIX C

SAMPLE POST OCCUPANCY EVALUATION QUESTIONNAIRES

C1: CBE Sample POE Questionnaire

C2: AUDE Sample POE Questionnaire

C3: CSBR Sample POE Questionnaire

C1: CBE Sample POE Questionnaire

Occupant Indoor Environmental Quality (IEQ) Survey™

How many years have you worked in this building?

- ☐ Less than 1 year
 - ☐ 1-2 years
 - ☐ 3-5 years
 - ☐ More than 5 years
-

How long have you been working at your present workspace?

- ☐ Less than 3 months
 - ☐ 4-6 months
 - ☐ 7-12 months
 - ☐ More than 1 year
-

In a typical week, how many hours do you spend in your workspace?

- ☐ 10 or less
 - ☐ 11-30
 - ☐ More than 30
-

How would you describe the work you do? (check all that apply)

- ☐ Administrative support
 - ☐ Technical
 - ☐ Professional
 - ☐ Managerial/supervisory
 - ☐ Other:
-

What is your age?

- ☐ 30 or under
 - ☐ 31-50
 - ☐ Over 50
-

What is your gender?

- ☐ Female
- ☐ Male

Which of the following best describes your personal workspace?

- ☐ Enclosed office, private
- ☐ Enclosed office, shared with other people
- ☐ Cubicles with high partitions (about five or more feet high)
- ☐ Cubicles with low partitions (lower than five feet high)
- ☐ Workspace in open office with no partitions (just desks)
- ☐ Other:

Office Layout

How satisfied are you with the amount of space available for individual work and storage?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  Very Dissatisfied

How satisfied are you with the level of visual privacy?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  Very Dissatisfied

How satisfied are you with ease of interaction with co-workers?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  Very Dissatisfied

Overall, does the office layout enhance or interfere with your ability to get your job done?

Enhances  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  Interferes

Please describe any other issues related to the office layout that are important to you.

Office Furnishings

How satisfied are you with the comfort of your office furnishings (chair, desk, computer, equipment, etc.)?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  Very Dissatisfied

How satisfied are you with your ability to adjust your furniture to meet your needs?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐  Very Dissatisfied

How satisfied are you with the colors and textures of flooring, furniture and surface finishes?

Very Satisfied          Very Dissatisfied

Do your office furnishings enhance or interfere with your ability to get your job done?

Enhances          Interferes

Please describe any other issues related to office furnishings that are important to you.

Thermal Comfort

Which of the following do you personally adjust or control in your workspace? (check all that apply)

- ☐ Window blinds or shades
- ☐ Operable window
- ☐ Thermostat
- ☐ Portable heater
- ☐ Permanent heater
- ☐ Room air-conditioning unit
- ☐ Portable fan
- ☐ Ceiling fan
- ☐ Adjustable air vent in wall or ceiling
- ☐ Adjustable floor air vent (diffuser)
- ☐ Door to interior space
- ☐ Door to exterior space
- ☐ None of the above
- ☐ Other:

How satisfied are you with the temperature in your workspace?

Very Satisfied          Very Dissatisfied

Overall, does your thermal comfort in your workspace enhance or interfere with your ability to get your job done?

Enhances          Interferes

Air Quality

How satisfied are you with the air quality in your workspace (i.e. stuffy/stale air, cleanliness, odors)?

Very Satisfied           Very Dissatisfied

Overall, does the air quality in your workspace enhance or interfere with your ability to get your job done?

Enhances           Interferes

Lighting

Which of the following controls do you have over the lighting in your workspace? (check all that apply)

- ☐ Light switch
- ☐ Light dimmer
- ☐ Window blinds or shades
- ☐ Desk (task) light
- ☐ None of the above

☐ Other:

How satisfied are you with the amount of light in your workspace?

Very Satisfied           Very Dissatisfied

How satisfied are you with the visual comfort of the lighting (e.g., glare, reflections, contrast)?

Very Satisfied           Very Dissatisfied

Overall, does the lighting quality enhance or interfere with your ability to get your job done?

Enhances           Interferes

Acoustic Quality

How satisfied are you with the noise level in your workspace?

Very Satisfied           Very Dissatisfied

How satisfied are you with the sound privacy in your workspace (ability to have conversations without your neighbors overhearing and vice versa)?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒  Very Dissatisfied

Overall, does the acoustic quality in your workspace enhance or interfere with your ability to get your job done?

Enhances  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒  Interferes

Cleanliness and Maintenance

How satisfied are you with general cleanliness of the overall building?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒  Very Dissatisfied

How satisfied are you with cleaning service provided for your workspace?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒  Very Dissatisfied

How satisfied are you with general maintenance of the building?

Very Satisfied  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒  Very Dissatisfied

Does the cleanliness and maintenance of this building enhance or interfere with your ability to get your job done?

Enhances  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒  Interferes

Building Features

Considering energy use, how efficiently is this building performing in your opinion?

Very energy efficient  ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒  Not at all energy efficient

Comments:

Please note that the list provided here is for demo purposes only, a maximum of four building features will be included on this page as part of a standard survey. For each of the building features listed below, please

indicate how satisfied you are with the effectiveness of that feature: Floor
air vents

Very Satisfied Very Dissatisfied

☐ I have no experience with it

Comments:

Thermostats

Very Satisfied          Very Dissatisfied

☐ I have no experience with it

Comments:

Light switches

Very Satisfied          Very Dissatisfied

☐ I have no experience with it

Comments:

Automatic daylight controls

Very Satisfied  ☒ ☐ ☐ ☐ ☐ ☐ ☐ ☐  Very Dissatisfied

☐ I have no experience with it

Comments:

Occupancy sensors for lighting

Very Satisfied Very Dissatisfied

☐ I have no experience with it

Comments:

Window blinds

Very Satisfied Very Dissatisfied

☐ I have no experience with it

Comments:

All things considered, how satisfied are you with your personal workspace?

Please estimate how your productivity is increased or decreased by the environmental conditions in this building (e.g. thermal, lighting, acoustics, cleanliness):



Any additional comments or recommendations about your personal workspace or building overall?

[illegible]

284

C2: Template 6 in the Guide to Post Occupancy Evaluation-
Sample Occupant Survey Questionnaire

Sample Occupant survey Questionnaire

This questionnaire is about occupant reaction to their environment. This is a basic questionnaire which can be used to explore user reactions to a building or part of building. The General section is about the respondent, the Location section is about responses to building or campus in general and reveals insights about the respondent's wellbeing. The Final section about specific locations and should be copied for each location that the review is to cover.

However, many situations will have unique characteristics and these will need to be added. There is merit in keeping the core of your questionnaire the same with project specific attributes being added in another section. This is so that it can be used across an estate in different buildings comparisons can be made.

Occupancy Questionnaire

Institution:

Building address:

Date:

Time:

Focus of review (if part of a building):

Introduction

We are conducting an evaluation of your building to assess how well it performs for those who occupy it. This information will be used to assess areas that need improvement, provide feedback for similar buildings and projects and to help us better manage the environment. Responses are anonymous. Please answer all the relevant questions.

General

1. Gender

Male

Female

(Please tick)

2. Occupation (Please tick most relevant or state in 'other')

Administrative staff

Researcher

Lecturer

Student

Other:

Full-time

Part time

3. Time in building

a. How long do you spend in the building during the day?

(Please tick)

Hours	>1	1-2	3-4	5-6	7-8	>8
-------	----	-----	-----	-----	-----	----

4. Hours at VDU

a. How long do you spend working at a computer (average hours per day)

(Please tick)

Hours	>1	1-2	3-4	5-6	7-8	>8
-------	----	-----	-----	-----	-----	----

Location in building

5. Location

In an average week how much time do you spend in the following types of space? (if you are a student assume during term time)

a: Office (Please tick)

Hours	0-5	6-10	11-15	16-20	21-25	26-30	31-35
>35							

b: Lecture room (Please tick)

Hours	0-5	6-10	11-15	16-20	21-25	26-30	31-35
>35							

c: Laboratory (Please tick)

Hours	0-5	6-10	11-15	16-20	21-25	26-30	31-35
>35							

d: Library (Please tick)

Hours	0-5	6-10	11-15	16-20	21-25	26-30	31-35
>35							

e: Café (Please tick)

Hours	0-5	6-10	11-15	16-20	21-25	26-30	31-35
>35							

f: Other (Please state)

Hours	0-5	6-10	11-15	16-20	21-25	26-30	31-35
>35							

5. Please rate the overall quality of the following areas:
(Please tick)

- a: Office
 Poor 1 2 3 4 5 6 7 Excellent
- b: Lecture room
 Poor 1 2 3 4 5 6 7 Excellent
- c: Laboratory
 Poor 1 2 3 4 5 6 7 Excellent
- d: Library
 Poor 1 2 3 4 5 6 7 Excellent
- e: Café
 Poor 1 2 3 4 5 6 7 Excellent
- f: Other (Please state):
 Poor 1 2 3 4 5 6 7 Excellent

Building Generally

6. Security

- a. Personal safety: How safe do you feel in the building?
(Please tick)
 Unsafe 1 2 3 4 5 6 7 Very safe
- b. What aspects of the environment contribute to feeling safe?
- i). Visibility of security personnel (Please tick)
 Not significant 1 2 3 4 5 6 7 Very significant
- ii). Access control to the building
 Not significant 1 2 3 4 5 6 7 Very significant
- iii). Security zoning (access controls to parts of building)
 Not significant 1 2 3 4 5 6 7 Very significant
- iv). Lighting
 Not significant 1 2 3 4 5 6 7 Very significant
- v) Spatial configuration (i.e. relatively large uncluttered spaces)
 Not significant 1 2 3 4 5 6 7 Very significant

7. Accessibility (can you get into it, can you get around the building / campus easily)

a). How accessible is the building from the street i.e. to the reception door?

(Please tick)

Not accessible 1 2 3 4 5 6 7 Very accessible

b). How easy is vertical circulation?

Very difficult 1 2 3 4 5 6 7 Very easy

c). How easy is horizontal circulation?

Very difficult 1 2 3 4 5 6 7 Very easy

8. Cleanliness

How clean is the building?

(Please tick)

Dirty 1 2 3 4 5 6 7 Clean

Location specific

9. Air quality

(Please tick)

a). Does the quality of the air in this part of the building have a negative effect on your work performance?

Not significant 1 2 3 4 5 6 7 Very significant

b). Is the air fresh or stale?

Stale 1 2 3 4 5 6 7 Fresh

c). Is the air humid or dry?

Too humid 1 2 3 4 5 6 7 Too dry

d). Is there air movement?

Still 1 2 3 4 5 6 7 Good circulation

e). Do you have control over ventilation?

No control 1 2 3 4 5 6 7 Full control

10. Temperature

(Please tick)

a). Does the temperature in this part of the building have a negative effect on your work performance?

Not significant 1 2 3 4 5 6 7 Very significant

b) Is the temperature in winter too cold or too hot?

Too cold 1 2 3 4 5 6 7 Too hot

c) Is the temperature during the summer too cold or too hot?

Too cold 1 2 3 4 5 6 7 Too hot

11. Noise

a). Does the distraction from noise in this part of the building have a negative effect on your work performance?

(Please tick)

Not significant 1 2 3 4 5 6 7 Very significant

b) Is there significant distraction from noise outside the space?

Not significant 1 2 3 4 5 6 7 Very significant

c) Is there significant distraction from background noise?

Not significant 1 2 3 4 5 6 7 Very significant

12. Light

a). Does the quality of light in this part of the building have a negative effect on your work performance?

(Please tick)

Not significant 1 2 3 4 5 6 7 Very significant

b) Is there too much or too little natural light?

Too little 1 2 3 4 5 6 7 Too much

c) Is the sun/natural light too bright?

Not bright 1 2 3 4 5 6 7 Too bright

d) Is the level of artificial light too high or low? *(Please tick)*

Too low 1 2 3 4 5 6 7 Too high

e) Is the artificial light too bright?

Not bright 1 2 3 4 5 6 7 Too bright

f) Are the blinds/shutters effective in blocking out natural light?

Not effective 1 2 3 4 5 6 7 Very effective

g) Do you have control over artificial lighting?

No control 1 2 3 4 5 6 7 Full control

13. IT / Data projection

Is the electronic data projection equipment effective?

Does not work well 1 2 3 4 5 6 7 Works well

14. Comments

If you have any additional comments that you would like to make about any aspect of your work environment. Please note them here. If relevant to a particular question please give the question number.

C3: Sample POE Questionnaire

Center for Sustainable Building Research, College of Architecture and Landscape

Architecture, University of Minnesota

Solid Waste Management Coordinating Board
Post Occupancy Evaluation: Carver County Public Works Facility
Occupant Survey Form

(1) What is your primary workspace?

For the following questions please circle a number from 1-7 that best reflects your response to the question.

(2) How healthy do you feel after completing your work in the building each day?

Very unhealthy 1 2 3 4 5 6 7 Very healthy

(3) How healthy do you feel when you are not in the building?

Very unhealthy 1 2 3 4 5 6 7 Very healthy

(4) To what extent do you think your productive work is affected by the interior environmental conditions of the building?

Greatly decreased 1 2 3 4 5 6 7 Greatly increased
No effect

(5) How satisfied are you with the quality of sound environment in your workspace? This includes sounds like echoes, equipment, HVAC, foot traffic, furniture movement, etc.?

Very dissatisfied 1 2 3 4 5 6 7 Very satisfied

(6) Do you notice vibration (e.g., from mechanical systems) in the building?
(Please check one.) _____ Yes _____ No

If you checked “**Yes**”, go to Question 7. If you checked “**No**”, go to Question 8.

(7) If you notice vibration (e.g., from mechanical systems) in the building how annoying is it?

Not at all annoying 1 2 3 4 5 6 7 Highly annoying

(8) How satisfied are you with your workspace furnishings?

Very dissatisfied 1 2 3 4 5 6 7 Very satisfied

(9) What kind of view of the outdoors do you have when you are seated in your workspace?

No view 1 2 3 4 5 6 7 Panoramic view
Very slight Expansive

(10) Do you have an operable window in your workspace?

(Please check one.) _____ Yes _____ No

(11) To what extent are you satisfied with the overall lighting in your workspace?

Very dissatisfied 1 2 3 4 5 6 7 Very satisfied

(12) How much natural light do you have in your workspace?

None 1 2 3 4 5 6 7 Almost like the outdoors

(13) How much glare do you experience in your workspace?

No glare 1 2 3 4 5 6 7 Very noticeable glare

(14) How satisfied are you with the temperature in your workspace during the heating season (winter months)?

Very dissatisfied 1 2 3 4 5 6 7 Very satisfied

(15) How satisfied are you with the temperature in your workspace during the cooling season (summer months)?

Very dissatisfied 1 2 3 4 5 6 7 Very satisfied

(16) How satisfied are you with the air quality in your workspace during the heating season (winter months)?

Very dissatisfied 1 2 3 4 5 6 7 Very satisfied

(17) How satisfied are you with air quality in your workspace during the cooling season (summer months)?

Very dissatisfied 1 2 3 4 5 6 7 Very satisfied

(18) How satisfied are you with the ventilation system in your workspace?

Very dissatisfied 1 2 3 4 5 6 7 Very satisfied

(19) Do you have any additional comments on building performance? Do you have any suggestions for how the building and/or landscape could be improved? If so, please explain them and rank the improvements in order of importance to you.

BIBLIOGRAPHY

BIBLIOGRAPHY

Ang G., Wyatt D., and Hermans M. (2001). A Systematic Approach Define Client Expectations of Total Building Performance During the Pre-design Stage. CIB World Building Congress, Wellington, New Zealand. Paper CLI 26.

AUDE and HEDQF (Association of University Directors of Estates and Higher Education Design Quality Forum). (2006). A Guide for Post Occupancy Evaluation. University of Westminster. (<http://www.aude.ac.uk/home>) as viewed in December 2008

Baird G., Gray J., Isaacs N., Kernohan D., and McIndoe G. (1996). Building Evaluation Techniques. New York: McGraw Hill.

Bechtel R., Marans R.W. and Michelson W. (1987). Methods in Environmental and Behavioral Research. Van Nostrand Reinhold, New York, NY.

Bechtel, R., and Srivastava, R. (1978). Post-Occupancy Evaluation of Housing, US Department of Housing and Urban Development, Washington, D.C., USA.

Bordass, W., Leaman, A. (2005), "Making feedback and post-occupancy evaluation routine 3: case studies of the use of techniques in the feedback portfolio", *Building Research and Information*, Vol. 33 No.4, pp.361-75.

Bordass, B. 2003, 'Learning more from our buildings or just forgetting less?', in *Building Research and Information*, vol.31, issue 5, pp. 406-411

Bottom C., McGreal S. and Heaney G. (1997). Evaluating office environments using tenant organization perceptions. *Facilities*, Vol. 15(7/8), pp.195-203

Brager G. S. and R.J.de Dear. (1998). A Standard for Natural Ventilation. *ASHRAE Journal*.

Brager G. S. and R.J.de Dear. (1998). Thermal Adaptation in the built environment: a literature review. *Energy and buildings*, Vol. 27(1), pp. 83-96

Brill M., Margulis S.T., Konar E. (1984). Using office design to increase productivity. Buffalo, N.Y. Workplace Design and Productivity, Inc.

Brooks S. Turpin and Viccars G. (2006). The development of robust methods of post occupancy evaluation. *Facilities* 24(5/6): 177-196

CABE (Commission for Architecture and the Built Environment). (2005). Design with distinction: the value of good buildings design in higher education. (www.cabe.org.uk) as viewed in August 2009

Capital projects: post-occupancy evaluation guidance. November 2007.

Carthey Jane. 2006. Post occupancy evaluation: development of a standard methodology for Australian health projects. *The international journal of construction management*, 2006, 57-74

Chiang Che-Ming and Lai Chi-ming. 2002. A Study on the Comprehensive Indicator of Indoor Environment Assessment for Occupants' Health in Taiwan. *Building and Environment* 37 387-392

Citherlet S. and Hand J. 2002. Assessing Energy, Lighting, Room Acoustics, Occupant Comfort and environmental impacts performance of building with a single simulation program. *Building and Environment* 37 845-856.

Collins Belinda L., Will Fisher, Gillette Gary, and Robert W. Marans. 1990. *Journal of the Illuminating Engineering Society*. 21-25

Duffy, F. (2000), "Design and facilities management in a time of change", *Facilities*, Vol. 18 No.10-12, pp.371-5.

Evans Gary W. and Johnson D. (2000). *Stress and Open-Office Noise*, *Journal of Applied Psychology*, Vol 85, 5, 779-783.

Farrenkopf Toni and Roth Vicki. 1980. The university faculty office as an environment. *Environment and Behavior* 12(4):467-477

Fleming David. 2005. The application of a behavioral approach to building evaluation. *Facilities*, Vol. 23(9/10), pp. 393-415

Friedman A., Zimring C., and Zube C. (1978). *Environmental Design Evaluation*, Plenum, New York, NY.

Garris Leah B.. 2003. Playing: solving the space planning puzzle. *Buildings* 97(10): 56
Green S.D. and Moss G.W. (1998). Value management and post-occupancy evaluation: closing the loop. *Facilities*, Vol. 16(1/2), pp. 34–39

Gonzalez Maria Soledad Rodriguez, Fernandez Constantino Arce and Cameselle Jose Manuel Sabucedo. 1997. Empirical validation of a model of user satisfaction with buildings and their environments as workplaces. *Journal of Environmental Psychology* 17:69-74.

Gossauer Elke and Wagner Andreas. 2007. Post-occupancy Evaluation and Thermal Comfort: State-of-the-art and New Approaches. Volume 1: 151-175

Gutman R. and Westergaard B. (1974). Building evaluation, user satisfaction and design. In J. Langet al. (eds.) *Designing for Human Behavior*. Stroudsburg, PA: Dowden, Hutchinson & Ross.

Hassanain Mohammad A. and Mudhei Ali A.. 2006. Post-occupancy evaluation of academic and research library. *Structural Survey*. Emerald Group Publishing Ltd. 24(3):230-239

Hitchcock Robert J. Piette Mary Ann, and Stephen E. Selkowitz. 1998. Documenting Performance Metrics in a Building Life-cycle Information System. *Green Building Challenge '98 conference*. 26-28

Horgen, T.H., Joroff, M.L., Porter, W.L., and Schon, D.A. 1999. *Excellence by Design: Transforming Workplace and Work Practice*. New York: Wiley.

Horgen Turid, Frewald Dori, Smith Bonne, Vischer Jacqueline. 1996. Post occupancy evaluation of facilities: a participatory approach to programming and design. *Facilities* 14 (7/8):16-25

<http://www.aude.ac.uk/home>

<http://www.capital.dhs.vic.gov.au/capdev/ThePOEStudy/>

As viewed in April 2008

Huizenga C., Zagreus L., Arens E., and Lehrer D. Measuring indoor environment quality: a web-based occupant satisfaction survey. Center for the Built Environment.
Huizenga C., Zagreus L., Arens E., and Lehrer D. Occupant Satisfaction with Indoor Environment Quality in Green Buildings. Center for the Built Environment. Proceedings of Healthy buildings 2006, Lisbon. Vol. III, pp. 365-370.

Jensen K.L., Arens E. and Zagreus L.. 2005. Acoustical quality in office workstations, as assessed by occupant surveys. Proceedings: Indoor Air 2005

Kantrowitz Min and Nordhaus Richard. 1980. The impact of post occupancy evaluation research: a case study. Environment and Behavior 12(4):508-519

Keys Christopher and Wener Richard. 1980. Organizational intervention issues: a four phase approach to post occupancy evaluation. Environment and Behavior 12(4):533-540

Kincaid David G. 1994. Measuring performance in facility management. Facilities 12(6):17-20

Kooymans R. and Haylock P. (2005). Post occupancy evaluation and work place productivity. Pre-published version.

Leaman, A. (2003) Post-occupancy Evaluation, Prepared for Gaia Research CPD Seminars on Sustainable Construction, January.

Leaman, A. and Bordass, B. (1993) Building design, complexity and manageability, Facilities, 11.

Leaman, A., Bordass, W., Cohen, R. and Standeven, M. (1997) The Probe Occupant Surveys, Buildings in Use'97: How Buildings Really Work, London, Commonwealth Institute.

Learning from Our Buildings: A State-of-the-Practice Summary of Post-occupancy Evaluation. 2002. Federal Facilities Council Technical Report No. 145, Washington, D.C.

Lee Y.S. (2007). The relationship between indoor environmental quality and worker satisfaction and performance in Leadership in Energy and Environmental Design (LEED[®]) certified buildings. Ph.D. Dissertation. University of Minnesota.

Levermore G. J. and Leventis M. (1997) Occupant feedback using a questionnaire rating liking and importance of up to 24 factors. In *Clima 2000 Conference*, Brussels, September.

Marans, R. (1984). "Evaluation Research in Architecture". Snyder, J. (ed.) Architectural research, Van Nostrand Reinhold, New York, pp. 113-124.

Menzies G.F. and Wherrett J.R. 2004. Windows in the Workplace: Examining Issues of Environmental Sustainability and Occupant Comfort in the Selection of Multi-glazed Windows. *Energy and Buildings* 37 (2005): 623–630

Moezzi Mithra and Goins John. April 2010. Using Text Analysis to Listen to Building Users. Proceedings of Conference: Adapting to Change: New Thinking on Comfort. Cumberland Lodge, Windsor, U.K.

Nicol, F. & Roaf, S. 2005, 'Post-occupancy evaluation and field studies of thermal comfort', in *Building Research and Information*, vol.33, issue 4, pp.338-346

Olesen, B.W., Brager, G.S. (2004), A Better Way to Predict Comfort: The New ASHRAE Standard 55-2004, *ASHRAE Journal*, August 2004 p20-26.

Peretti Clara, Schiavon Stefano, Goins John, Arens Edward A., and De Carli Michele. January 2010. Evaluation of Indoor Environment Quality with a Web-based Occupant Satisfaction Survey: A Case Study in Northern Italy. Center for the Built Environment (CBE), University of California, Berkeley.

Pfafferott J.U., Herkel S., Kalz D.E. and Andreas Z. (2007). Comparison of low-energy office buildings in summer using different thermal comfort criteria. *Energy and Buildings* 39 (2007) 750-757

CSBR (Center for Sustainable Building Research). 2004. University of Minnesota. Post Occupancy Evaluation of Carver County Public Works Facility. Prepared for the Solid Waste Management Coordinating Board by the CSBR.

Preiser W.F.E. and Nascar J.L. (2008). Assessing building performance: its evolution from post occupancy evaluation. *Archnet-IJAR*, Vol. 2(1), pp. 84-99

Preiser W.F.E. (2002). Continuous quality improvement through post occupancy evaluation feedback. *Journal of Corporate Real Estate*, Vol. 5(1), pp. 42-56

Preiser W.F.E., and Schramm U. (2001). Intelligent office building performance evaluation in the cross-cultural context: A methodological outline. *Intelligent Building I* (1).

Preiser, W.F.E. (1999). Post-occupancy evaluation: Conceptual basis, benefits and uses. In: Stein, J.M., and Spreckelmeyer, K.F. (Eds.) *Classical Readings in Architecture*. New York: McGraw-Hill.

Preiser, W.F.E., and Schramm, U. (1997). Building performance evaluation. In: Watson, D., et al. (Eds.) *Time-Saver Standards: Architectural Design Data*. New York: McGraw-Hill.

Preiser W.F.E. (1995). Post-occupancy evaluation: how to make buildings work better. *Facilities*, Vol.13(11), pp.19-28

Preiser, W.F.E., Rabinowitz, H.Z., and White, E.T. (1988). *Post-Occupancy Evaluation*. New York: Van Nostrand Reinhold.

Preiser, W.F.E. (1983). The habitability framework: A conceptual approach toward linking human behavior and physical environment. *Design Studies* 4(2).

R.I.B.A. (Royal Institute of British Architects). (1991). A Research Report for the Architectural Profession. Architectural knowledge: the idea of a profession, E & FN Spon, London.

Royal children's hospital post occupancy evaluation. (2001). Report by Queensland Health & Royal Children's Hospital Health District.

Salter C., Powell K., Begault D. and Alavarado R. (2003). *Case studies of a method for predicting speech privacy in the contemporary workplace*, Center For The Built Environment, UC Berkeley.

Schakib-Ekbatan Karin, Wagner Andreas, and Lussac Cedrine. April 2010. Occupant Satisfaction as an Indicator for the Socio-cultural Dimension of Sustainable Office Buildings- Development of an Overall Building Index. Cumberland Lodge, Windsor, U.K.

Schneekloth L.H. and Shibley R.G. (1995). Placemaking: The art and practise of building communities. New York: Wiley

Shibley, R. (1982). Building evaluations services. *Progressive Architecture* 63(12): 64-67.

Sundstrom E., Town JP., Rice RW., Osborn DP. and Brill M. (1994) *Office noise, satisfaction and performance*, Environment and Behavior, Vol 26, No. 2, 195-222.

Tarricone P. (1999). The power of POE. Facilities Design and Management, pp. 52-54

Van der Voordt, T.J.M 2004, 'Productivity and employee satisfaction in flexible workplaces', *Journal of Corporate Real Estate* Vol. 6, No. 2, pp. 133-148

Vischer, J. (2001). "Post-Occupancy Evaluation: A Multifaceted Tool for Building Improvement", Learning from our buildings: a state-of-the-practice summary of post-occupancy evaluation, Washington DC, National Academy Press, 23-34.

Watson Christopher G. 1996. Evolving design for changing values and ways of life. A paper for IAPS 14 Conference in Stockholm on July 30 1996.

Way M. and Bordass B. 2005. Soft Landings: a fresh scope that ensures users and clients get the best out of a new building. *Journal of Facilities Management* 4(1):23-39

Web-based survey to measure occupant satisfaction with building indoor environment quality (thermal comfort, lighting, acoustics, air quality), building quality and features. Center for built environment. As viewed in March 2008.

Zagreus L., Huizenga C., Arens E., and Lehrer D. (2004). Listening to the occupants: a Web-based indoor environmental quality survey. *Indoor Air*. Vol. 14(8), pp. 65–74

Zimmerman, A., and Martin, M. (2001). "Post-Occupancy Evaluation: Benefits and Barriers", *Building Research & Information*, 29(2), 168.

Zimring, C. and Rosenheck, T. (2001) Post occupancy evaluations and organizational learning, In: Federal Facilities Council, Technical Report 145: Learning From our Buildings: a State-of-the-Practice Summary of Post-occupancy Evaluation. Washington. National Academy Press, pp. 42–53.

Zimring C. and Reizenstein J.E. (1980). Post occupancy evaluation: an overview. *Environment and Behavior*, Vol. 12(4), pp. 429-450