

GREEN BUILDINGS, ENVIRONMENTAL AWARENESS, AND ORGANIZATIONAL IMAGE

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ABSTRACT

The paper reports a study that was conducted to understand the relationships between the occupants' assessments of the environmental design features of a "green" building and their assessments of environmental awareness (EA) and organizational image (OI). The study hypothesized that the occupant's assessments of individual workspace and departmental space features of a "green" building would directly affect their assessments of EA and OI, or that the occupant's assessments of individual workspace and departmental space features would indirectly affect their assessments of EA and OI through their satisfaction with individual workspace, departmental spaces and/or the building. In order to test these hypotheses, data were collected from 175 occupants of the Gold-level LEED-certified "green" building using a questionnaire instrument. Using frequency, correlational, and regression analyses of the data, the study found little or no evidence for direct relationships between the occupant's assessments of individual workspace and departmental space features and their assessments of EA and OI. The study, however, found some evidence for indirect relationships between the occupant's assessments of individual workspace and departmental space features and their assessment of EA and OI. The evidence showed that the occupant's assessments of individual workspace and departmental space features had affected their satisfaction with individual workspaces and the building, which then affected the occupants' assessments of EA and OI. The study is important for it provides evidence for connecting green buildings to organizational benefits and values.

Keywords: Green Buildings, Leadership in Energy and Environmental Design (LEED), Environmental Awareness, Organizational Image

Paper Classification: Research Paper

INTRODUCTION

For the purpose of this paper, any building with a Leadership in Energy and Environmental Design (LEED) certification from the US Green Building Council (USGBC) is considered a “green building.” The USGBC’s LEED rating system is a nationally accepted third party certification program for green building design, construction, and operation. The rating system promotes sustainability by recognizing performance in five key areas: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality (IEQ). It provides four levels of certification—basic certification, Silver, Gold, and Platinum—based on building performance measured using a set of prerequisites and credits in the five key areas listed above. Each higher level of certification represents an incremental step toward integrating the different components of sustainable design, construction, and operation to achieve optimal building performance. At present, the LEED rating system provides certifications for new construction and renovation, operations and maintenance of existing buildings, design of commercial interiors, building core and shell development, and neighborhood development and homes.

The USGBC and its LEED rating system have become hugely important for the US building industry in the context of global climate change and environmental sustainability. Buildings are one of the heaviest consumers of natural resources and account for a significant portion of the greenhouse gas emissions affecting climate change. In the US, buildings represent 38.9% of primary energy use, 38% of all CO₂ emissions, and 72% of electricity consumption (EIA, 2008). Buildings also use 13.6% of all potable water, or 15 trillion gallons per year (USGS, 2000). Additionally, they use 40% of raw materials globally (3 billion tons annually) (Roodman et al., 1996). The Environmental Protection Agency (EPA) of the US Government estimates that 170 Million tons of building-related construction and demolition (C&D) debris was generated in the US in 2003, with 61% coming from nonresidential and 39% from residential source (US EPA, 2009).

In the US, the green building market was 2% of non-residential construction starts in 2005; 10-12% in 2008; and will grow to 20.25% by 2013 becoming a \$96-140 billion market (McGraw Hill Construction , 2009). As of October 2010, there were 19,101 commercial LEED registered projects, and 7,368 LEED certified projects. The cumulative square footage of all commercial LEED certified projects was over 1 billion and growing. Also as of October 2010, the USGBC had 80 local chapters, over 30,000 individual members, and 157,000 LEED credentialed professionals across all areas of practice (www.usgbc.org). The factors driving the green building market and its related professional developments in the US

include government initiatives to reduce greenhouse gasses and energy consumption, heightened demand for green construction, and improvements in sustainable materials and technology (FMI, 2008).

THE PROBLEM

Despite the growing importance and interests, studies reported on the outcomes of LEED-certified green buildings are uneven. Many studies focus on cost related outcomes of these buildings suggesting that they save money. For example, in one report it is suggested that an upfront investment of 2% in green building design, on average, results in life cycle savings of 20% of the total construction costs - more than ten times the initial investment (Kats, 2003). In another, it is suggested that building sale prices for energy efficient buildings are as much as 10% higher per square foot than conventional buildings (Miller et al., 2007). Many other studies focus on resource and operational efficiency of green buildings suggesting that they consume less energy and fewer resources. For example, a post-occupancy evaluation of 12 General Services Administration (GSA) green buildings reports that in comparison to the average commercial building, these green buildings consume 26% less energy, have 13% lower maintenance costs, and have 33% less greenhouse gas emissions (GSA PBS, 2008).

In contrast, fewer studies focus on individual benefits and values of green buildings. These studies in general suggest that the IEQ of green buildings are more conducive to individual performance, health, comfort and satisfaction than that of conventional buildings (Browning and Romm, 1995). That is because the prerequisites and credits for IEQ in the LEED rating system are among those that are already known to have positive effects on building occupants. For example, inclusion of high quality energy efficient lighting may reduce computer glare and increase visual comfort, increased use of day lighting may reduce energy demands and enhance interior lighting quality, certain construction practices may eliminate moisture build up and reduce mold growth, advanced ventilation and mechanical systems may increase air flow and reduce occupants' contact with airborne microbial agents, or design strategies that reduce sick building syndromes (SBS) may have positive effects on health and work performance. For a review of the related literature see (Rashid and Zimring, 2008).

Although outcomes related to cost, efficiency, and individual benefits and values are important, studies focusing on the potential connections between green buildings and organizational benefits and values are still missing. This is likely to be an important factor in the long-term market growth of green

buildings, because organizational leaders who want to use green buildings to enhance organizational values and benefits do not yet have the necessary evidence they need to make their case. It is in this context, this paper studies the effects the environmental design features of green buildings on environmental awareness and organizational image.

LINKING GREEN BUILDINGS TO ENVIRONMENTAL AWARENESS AND ORGANIZATIONAL IMAGE

Buildings may be the most visible asset of an organization, but how may they affect organizational image (OI) is not well understood. More importantly, organizational image projected by buildings may also be linked to environmental awareness (EA). As early as 1993, in an extensive evaluation of companies in UK and Europe, Hodgkinson (1993) noted that businesses would increasingly want their flagship buildings to present an image of environmental friendliness in terms of energy efficiency, the use of building materials, and the impact on the wider environment. In a 1999 survey by BOMA International and the Urban Land Institute, 72% of building tenants maintained that it was important for their buildings to project an image of environmental friendliness (Baier, 1999). With increasing public awareness, commitment to environmental sustainability has become an important organizational asset. It is suggested in the literature that companies with the best environmental records would not only have a higher standing with the public, they would also develop more positive relationships with environmental regulators (Makower, 1994).

The benefits of green buildings in relation to EA and OI, however, are more likely to occur when buildings and organizations are treated as integrated systems. As Cole (1999) points out, when there is a lack of systems integration it is entirely possible to have a “green” building with “gray” occupants who do not have the appropriate knowledge to use the building. “Gray” occupants are also more likely to be found in buildings that “green” individual systems rather than the environment as a whole, or in buildings which focus primarily on technology and materials to the exclusion of social and psychological mechanisms at work in the organization. Further, it is possible to have “green” buildings occupied by “gray” organizations that pass up significant benefits offered by these buildings in terms of resource and operational efficiency, and human and organizational values. Therefore, to understand how the benefits of green buildings may accrue in relation to EA and OI, it is necessary to begin with the occupants of green buildings.

For this study, it is assumed that occupants' assessments of the "green" environmental features of a LEED-certified building may affect their assessments of EA and OI directly and/or indirectly [Figure 1]. In the direct way, the occupant's assessments of individual workspace and departmental space features of a LEED-certified building may affect how the occupants' assess EA and OI. In the indirect way, the occupant's assessments of individual workspace and departmental space features of a LEED-certified building may affect their satisfaction with individual and departmental spaces and with the building, which may then affect how the occupants' assess EA and OI.

[Insert Figure 1 about here]

More specifically, in the first part this study focuses on the following three questions to find out any direct effects of the occupant's assessments of environmental features on EA and OI:

1. Do the occupants of a LEED-certified green building assess various environmental features of the building favorably? If the occupants do not have a favorable view of these features, then it may be pointless to pursue the study any further.
2. Do the occupants of a LEED-certified green building agree that these buildings have positive effects on EA and OI? Despite having a favorable view of various environmental features if the occupants believe that the building does not positively affect EA and OI, then it is possible that the building uses "green" environmental features to the exclusion of some of the social and psychological mechanisms at work in the organization.
3. Finally, what is the relationship between the occupants' assessments of various environmental features of a LEED-certified green building and their assessments of EA and OI? This relationship may help us describe whether a green building is occupied by "gray" occupants or not. If there is no relationship between the occupants' assessments of the "green" environmental features and their assessments of EA and OI, then it is possible that that the benefits offered by the building are unknown to the occupants, something that can be observed among "gray" occupants.

In the second part, this study then focuses on the following three questions to find out any indirect effects of the occupant's assessments of environmental features on EA and OI via the occupants' satisfaction with individual workspaces, departmental spaces, and the building:

4. Are the occupants of a LEED-certified building generally satisfied with individual workspaces, departmental spaces, and the building? If the occupants are not satisfied with these spaces and/or the building but still assess various environmental features of these buildings favorably,

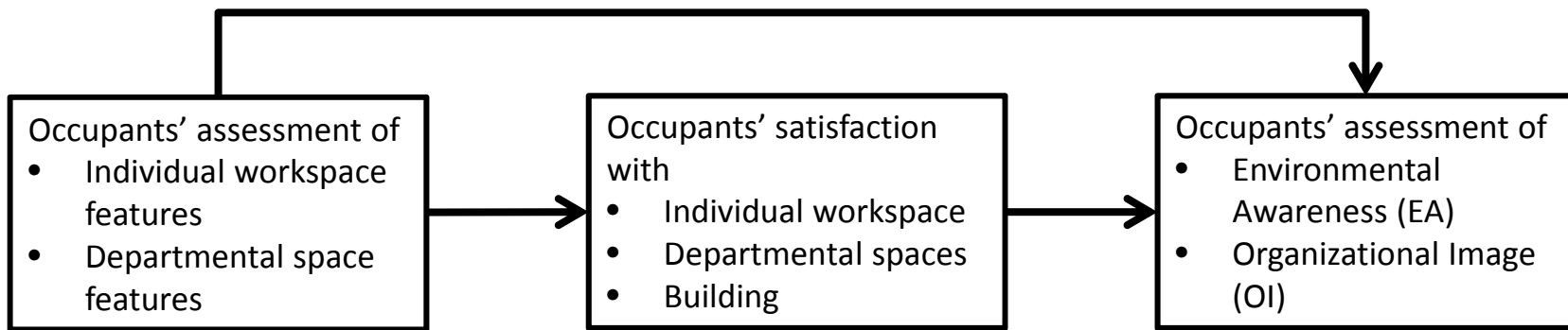


Figure 1: The study model

then the occupants' satisfaction must depend on something else of the building and/or the organization. Likewise, if the occupants are not satisfied with these spaces and/or the building but still believe that the building has positive effects on EA and OI, then the occupants' assessments of EA and OI must depend on something else of the building and/or the organization.

5. If the occupants of a LEED-certified building are generally satisfied with individual workspaces, departmental spaces and the building, then what is the relationship between the occupants' assessments of various environmental features of a LEED-certified green building and their satisfaction?
6. Finally, if the occupants of a LEED-certified building are generally satisfied with individual workspaces, departmental spaces, and the building, then what is the relationship between the occupants' satisfaction and their assessments of EA and OI?

THE CASE STUDY

The study was conducted at a Gold-level LEED-certified public office building. [Figures 2-9](#) show the office building and a few selected spaces within the building. Environmental highlights of the building in the five key areas of the LEED rating systems include the following:

Water. The building uses bio-swales to clean parking lot run-off, and bio-filter in the lobby to clean rain water from roof. It also uses native or adapted grass and plant species to reduce water consumption. Its site irrigation system is rain fed. The building includes grey water recycling system for toilet flushing, low-flow and hands free faucets and fixtures, and waterless urinals.

Energy. The building uses highly efficient mechanical systems, and floor plenum displacement ventilation. It also uses sophisticated building automation system. The building includes significant amount of day lighting, and high efficiency indirect computer controlled lighting to reduce the need for artificial lighting. It was also designed for 45% energy use reduction below a code minimum building.

Site. The building was designed to reduce site disturbances. It preserved existing trees and habitats. The building has full cut-off lighting fixtures to help minimize light pollution in and around the site.

Materials. The building diverted 90% of construction waste. 20% of all materials used in the building were manufactured within 500 mile radius of site. It used reclaimed cedar from demolished building. It also used recycled glass chips for terrazzo floor, and high recycled-content steel structure, carpet fiber and other materials. Further, it used corn based fabrics.

Indoor Environmental Quality (IEQ). The building uses sustainable materials and furniture with off-gassing volatile organic compounds (VOCs). It has systems of containment for source pollutants. It also provide high amount of fresh air intake. Each individual office space has HVAC control. Private offices are placed inside and workstations are placed around the perimeter. As a result, more workers have access to natural light and outside view. Office workers also share several amenities including a huge well-lit atrium, well-lit corridors with invitingly warm woodwork, technology-enhanced conference spaces with outdoor views, and improved service areas. The building also has a system of green housekeeping in place.

Recognitions received in addition to the Gold-level LEED certification. The building received the 2005 Achievement Award for making the design-build Process work for County Government by the National Association of Counties, the 2005 Public Technology Institute Award, the 2006 Excellence Award by the Design-Build Institute of America, the 2006 Merit Award for Excellence in Architecture by Kansas Chapter of the AIA, the 2006 Excellence Award by the Mid-America Chapter of the Design-Build Institute of America, the 2006 Award for Merit by Kansas City AIA Committee on the Environment, the 2007 KC Business Journal Capstone Award, the 2007 Construction Specifications Institute (CSI) Environmental Stewardship Award, the 2007 Achievement Award for setting a new standard for public capital investment by the National Association of Counties, the 2007 EPA Blue Skyways Partnership Award, and the 2007 Bridging the Gap Environmental Excellence award for Business.

[Insert **Figures 2–9** about here]

METHODS

Data collection methods. Data for the study were collected via an anonymous questionnaire survey. Institutional Review Board (IRB) approval for the survey was obtained from the Human Subjects Committee of the involved institution. The IRB-required information and cover sheets were attached to



Figure 2: A view of the building showing bio-swales, trees, and habitats.



Figure 3: The reflecting pool at the entrance of the building works as a retention pond.

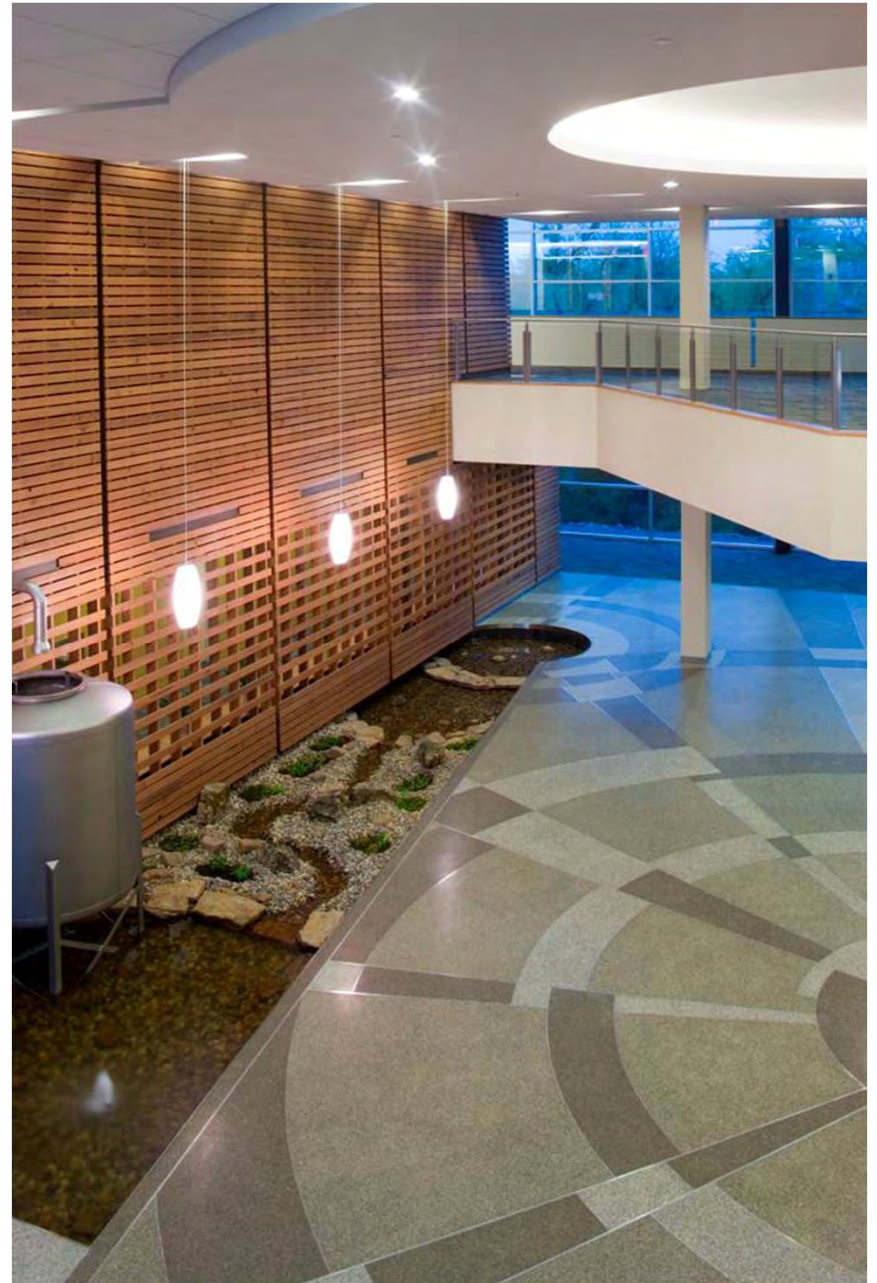


Figure 4: The bio-filter in the lobby of the building helps clean rain water from the roof.



Figure 5: Ample natural light reduces the need for artificial lighting in the building.



Figure 6: Each workstation in the building has ample natural light and easy access to natural view.



Figure 7: Technology-enhanced conference spaces also have natural light and views.



Figure 8: A view of a lounge area.



Figure 9: A view of a group meeting space.

the questionnaire to ensure that participating office workers fully understood the intent of the study and the consequences of their participation. The purpose and methods of the survey were discussed with office managers, who then described these to office workers. Participation in the study was voluntary. On the day of survey, research representatives left the questionnaire on each office worker's desk. Office workers could complete the questionnaire any time during a period of one week after they received the questionnaire. The respondent put the filled-out questionnaire in a sealed envelope and returned it to boxes kept at predetermined locations within the building.

The questionnaire. The questionnaire was developed for a much larger study of office workers (References omitted for peer review). Among the many questions included in the questionnaire, this study utilized only some of those related to individual background, workplace design, and individual and organizational outcomes. Questions on individual background included gender, job type and age group. Questions on workplace design included some on environmental features of individual workspaces, and others on departmental spaces or common amenities [Table 1]. They also included questions on satisfaction with workspaces, departmental spaces and the building. Among the many questions on organizational outcomes, some were regrouped to create two multi-item scales describing organizational image and environmental awareness [Table 2]. The questionnaire utilized a five-point bipolar scale to score responses against each question related to environmental features, satisfaction, and organizational outcomes.

[Insert Tables 1 & 2 about here]

Data analysis methods. Altogether, the building had 284 office workers at the time of the survey. There were 175 appropriately filled out questionnaires (response rate: 61.6%). The numbers of valid returns by gender, job type, and age group are given in Table 3. Questionnaire data were manually entered into an SPSS (SPSS Inc., Chicago, IL) database. Standard data checking and verification were performed (e.g., range, distribution, pattern of missing values). Factor analyses of the two scales —EA and OI—extracted one primary component for each, therefore no item was eliminated. Reliability analyses showed the scales to have acceptable Cronbach's alpha values [Table 2].

The following analyses were completed to find out the answers to the six study questions posed earlier:

1. For the first question, frequencies of the responses on the questions related to individual workspace and departmental space features were analyzed.

Workspace related questions	Departmental space related questions
amount of area in personal workspace fits needs	can socialize in corridors/circulation areas
sufficient work surfaces in workspace	can socialize in lounge/break room
enough storage in workspace	can socialize in coffee/snack bar
furniture in workspace is sufficient	building provides opportunities for informal conversation
can enjoy outside view	people I need to work with are close to my work area
can adjust workspace for needs	shared spaces for teamwork/impromptu meetings
workspace helps accomplishing tasks	have no difficulty finding people needed to get work done
have enough privacy	can choose where I get work done in bldg.
can adjust workspace to increase privacy	have easy access to equipment
conversations with co-workers cannot be overheard	do not have to go out of way to get info from co-workers
phone conversations cannot be overheard	support equipment is convenient to workspace
have enough privacy to do job well	layout of departmental workspace supports teamwork
have enough natural light in workspace	layout of department supports impromptu meetings
workspace is not too bright	office does not lack informal meeting spaces
lighting at desk helps job	conference and/or training rooms support tasks
have enough fresh air in workspace	conference spaces available when needed
happy with air quality	conference spaces have suitable sizes
not too hot in workspace	office spaces are flexible
not too cold in workspace	
air not too dry in workspace	

Table 1: Individual workspace and departmental space related questions

Scales	Items	Factor Analysis Extraction Method: Principal Component Analysis	Cronbach's Alpha
Organizational Image	<ol style="list-style-type: none"> 1. public image improved since we relocated in this building 2. organization hires better people since we relocated in this building 3. having a job in this building carries a positive image 4. employees respect job more since we relocated in this building 5. respect my job more since we relocated in this building 6. this building affects my desire to stay with the organization 	One primary component was extracted	0.884
Environmental Awareness	<ol style="list-style-type: none"> 1. this building has a positive effect on the environment 2. our reputation as an environment conscious org improved since we relocated 3. employees care more about environment since we relocated in this building 4. I care more about environment since we relocated in this building 5. employees believe all buildings should be designed like this building 6. I believe all buildings should be designed like this building 7. this building helps conserve energy 8. this building provides healthy work environment 	One primary component was extracted	0.899

Table 2: Items in the organizational image and environmental awareness scales and their Cronbach's Alpha values

Total Number of participants = 175														
	Gender			Job Type					Age Group					
	Male	Female	Total	SM	MM	P	S	Total	Below 30	31-40	41-50	51-60	Over 60	Total
Organizational image	70	89	159	13	31	46	67	157	13	32	48	58	7	158
Environmental Awareness	72	90	162	13	32	48	67	160	13	34	49	58	7	161

SM: Senior Manager. MM: Mid-level Manager. P: Professionals. S: Staff

Table 3: Valid returns by gender, job type, and age group

2. For the second question, frequencies of the responses on the EA and OI scales were analyzed. These responses were then broken down according to gender, job type, and age group to find out if these categories had any differential effects on the occupants' assessments of EA and OI.
3. For the third question, correlational analyses between the occupants' assessments of workplace environmental design features and their assessments of EA and OI were performed; and regression models were developed with the occupants' assessments of workplace environmental design features as the predictor variables and their assessments of EA and OI as the dependent variables.
4. For the fourth question, frequencies of the responses on the questions related to satisfaction with individual workspaces, departmental spaces and the building were analyzed.
5. For the fifth question, regression models were developed with the occupants' assessments of workplace environmental variables as the predictor variables and their satisfaction with individual workspaces, departmental spaces and the building as the dependent variables.
6. Finally, for the sixth question, regression models were developed with the occupants' satisfaction with individual workspaces, departmental spaces and the building as the predictor variables and their assessments of EA and OI as the dependent variables.

RESULTS

Table 4 & Figure10 show the results of the analysis of the frequencies of the occupants' assessments of workspace features. More occupants agreed than disagreed with the following workspace features: (1) amount of area in personal workspace fits needs, (2) have sufficient work surfaces in workspace, (3) have enough storage in workspace, (4) furniture in workspace is sufficient, (5) can enjoy outside view, (6) can adjust workspace for needs, (7) workspace helps accomplishing tasks, (8) have enough natural light in workspace, (9) workspace is not too bright, (10) lighting at desk helps job, (11) have enough fresh air in workspace, (12) happy with air quality, (13) not too hot in workspace, (14) not too cold in workspace, (15) air not too dry in workspace, and (16) satisfied with workspace. In contrast, more occupants disagreed than agreed with the following workspace features: (1) have enough privacy, (2) can adjust workspace to increase privacy, (3) conversations with co-workers cannot be overheard, (4) phone conversations cannot be overheard, and (5) have enough privacy to do job well.

	Disagree (%)	Neutral (%)	Agree (%)
amount of area in personal workspace fits needs	22.9	7.8	69.3
sufficient work surfaces in workspace	41.3	11.7	47
enough storage in workspace	29.6	18.4	52
furniture in workspace is sufficient	13.4	16.2	70.4
can enjoy outside view	24.3	37.9	37.8
can adjust workspace for needs	31.8	24.6	43.6
workspace helps accomplishing tasks	26.8	18.4	54.8
have enough privacy	62	19	19
can adjust workspace to increase privacy	82.7	8.9	8.4
conversations with co-workers cannot be overheard	88.8	6.7	4.5
phone conversations cannot be overheard	89.4	6.1	4.5
have enough privacy to do job well	43.6	26.3	30.1
have enough natural light in workspace	36.9	20.7	42.4
workspace is not too bright	10.1	17.3	72.6
lighting at desk helps job	17.3	24.6	58.1
have enough fresh air in workspace	29.1	28.5	42.4
happy with air quality	21.2	33	45.8
not too hot in workspace	29.1	21.8	49.1
not too cold in workspace	34.1	20.7	45.2
air not too dry in workspace	22.9	45.8	31.3

Table 4: Occupants' responses to individual workspace related questions

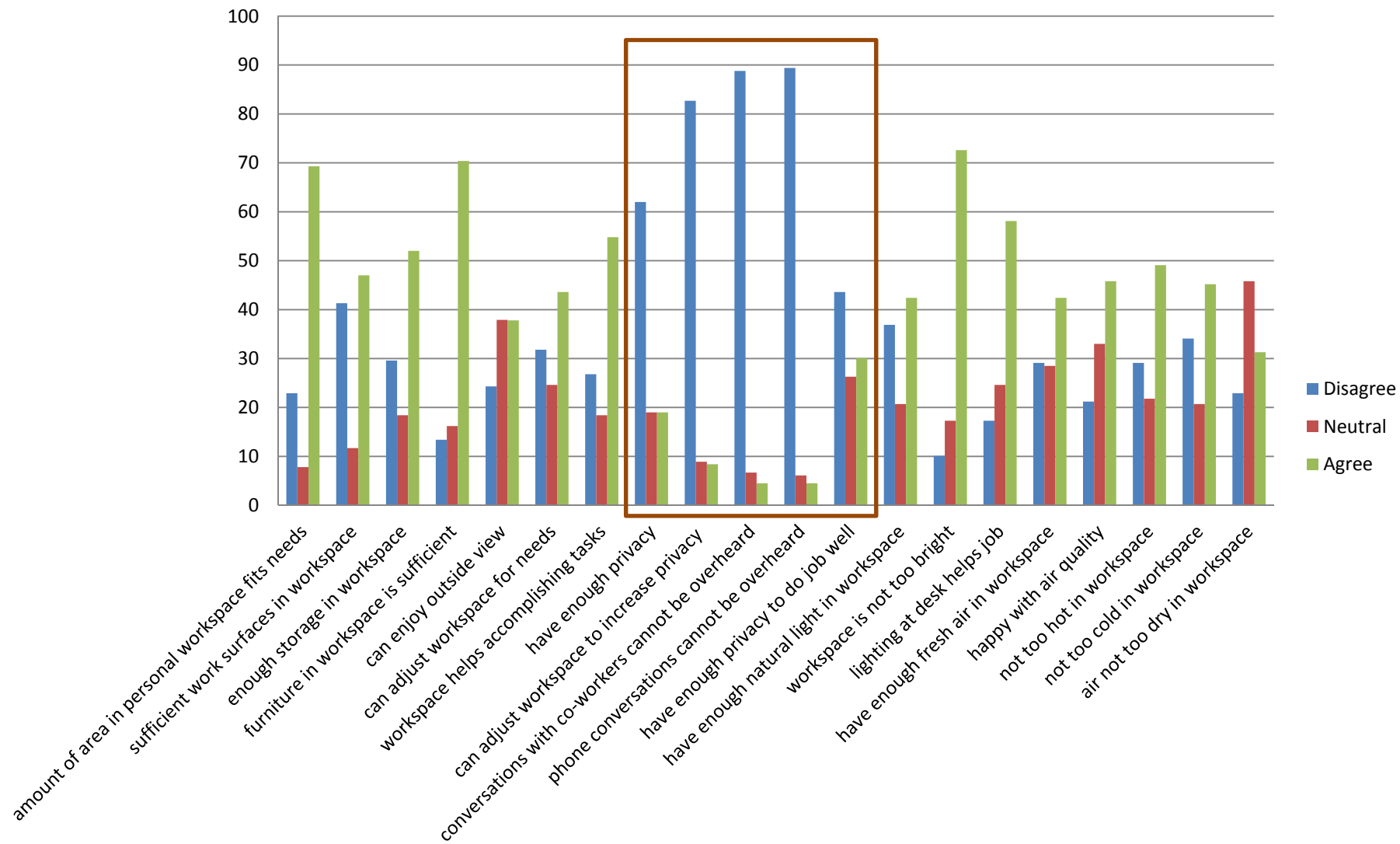


Figure 10: Occupants' responses to individual workspace related questions

[Insert Table 4 & Figure10 about here]

Table 5 & Figure11 show the results of the analysis of the frequencies of the occupants' assessments of departmental space features. More occupants agreed than disagreed with the following departmental space features: (1) can socialize in corridors/circulation areas, (2) can socialize in lounge/break room, (3) can socialize in coffee/snack bar, (4) building provides opportunities for informal conversation, (5) people I need to work with are close to my work area, (6) have shared spaces for teamwork/impromptu meetings, (7) have no difficulty finding people needed to get work done, (8) have easy access to equipment, (9) do not have to go out of way to get info from co-workers, (10) support equipment is convenient to workspace, (11) layout of departmental workspace supports teamwork, (12) layout of department supports impromptu meetings, (13) office does not lack informal meeting spaces, (14) conference and/or training rooms support tasks, (15) conference spaces available when needed, (16) conference spaces have suitable sizes, (17) office spaces in the department are flexible, (18) satisfied with location of workspaces in the department, and (19) satisfied with the layout of department. In contrast, more occupants disagreed than agreed with the following departmental space feature: (1) can choose where I get my work done in bldg.

[Insert Table 5 & Figure11 about here]

Tables 6, 7 & 8 and Figures 12, 13 &14 show the results of the analysis of the frequencies of the occupants' assessments of EA and OI. More occupants agreed than disagreed that the building helped improve their EA. In contrast, more occupants disagreed than agreed that the building helped improve their OI. These findings do not change for gender, job type, and age group except for the over 60 age group. For this age group, the percentage of occupants who agreed that the building helped improve their EA and OI was equal to the percentage of occupants who disagreed that the building helped improve their EA and OI.

[Insert Tables 6, 7 & 8 and Figures 12, 13 &14 about here]

Tables 9–11 show the results of the correlational and regression analysis studying the relationships between the occupants' assessments of individual workspace and departmental space features and that of EA and OI. The occupants' assessments of most individual workspace features showed significant correlation with that of EA and OI [Table 9]. However, a regression analysis with OI as the dependent variable and workspace features showing significant correlations as the predictor variables returned no

	Disagree (%)	Neutral (%)	Agree (%)
can socialize in corridors/circulation areas	15.9	17.6	66.5
can socialize in lounge/break room	21.3	25.3	53.4
can socialize in coffee/snack bar	20.3	27.9	51.8
building provides opportunities for informal conversation	17	19.3	63.7
people I need to work with are close to my work area	15.3	9.7	75
shared spaces for teamwork/impromptu meetings	14.2	13.1	72.7
have no difficulty finding people needed to get work done	25.6	18.8	55.6
can choose where I get work done in bldg.	65.3	19.9	14.8
have easy access to equipment	5.7	10.2	84.1
do not have to go out of way to get info from co-workers	26.1	18.8	55.1
support equipment is convenient to workspace	27.3	11.9	60.8
layout of departmental workspace supports teamwork	29	21	50
layout of department supports impromptu meetings	30.7	25	44.3
office does not lack informal meeting spaces	26.1	22.7	51.2
conference and/or training rooms support tasks	15.9	21.6	62.5
conference spaces available when needed	22.2	32.4	45.4
conference spaces have suitable sizes	25	23.3	51.7
office spaces are flexible	25.6	30.1	44.3

Table 5: Occupants' responses to departmental space related questions

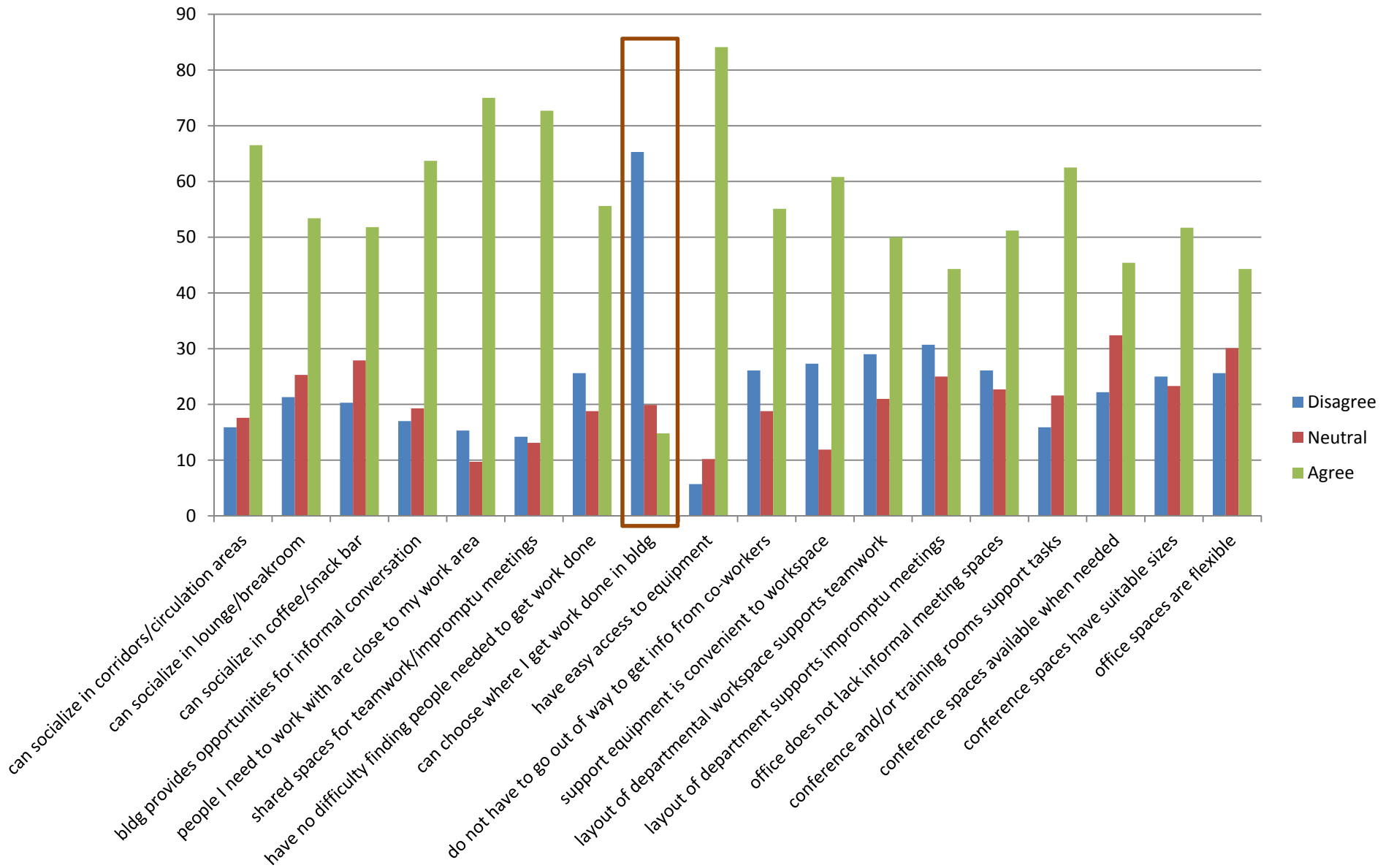


Figure 11: Occupants' responses to departmental space related questions

	Disagreed (%)			Neutral (%)			Agreed (%)		
	All	Male	Female	All	Male	Female	All	Male	Female
Did “Organizational Image” improve?	45.3	44.3	42.7	22.1	18.6	24.7	23.6	37.1	32.6
Did “Environmental Awareness “ improve?	24.6	23.6	23.3	9.7	9.7	7.8	65.7	66.7	68.9

Table 6: Occupants’ assessment of organizational image and environmental awareness by gender

	Disagreed (%)					Neutral (%)					Agreed (%)				
	All	SM	MM	P	S	All	SM	MM	P	S	All	SM	MM	P	S
“Organizational Image” improved	45.3	53.8	48.4	39.1	43.3	22.1	0	25.8	21.7	23.9	23.6	46.2	25.8	39.2	32.8
“Environmental Awareness “ improved	24.6	15.4	15.6	29.2	22.4	9.7	0	15.6	6.3	7.5	65.7	84.6	68.8	64.5	70.1

SM: Senior Manager. MM: Mid-level Manager. P: Professionals. S: Staff

Table 7: Occupants’ assessment of organizational image and environmental awareness by job type

	Disagreed (%)						Neutral (%)						Agreed (%)					
	All	Below 30	31-40	41-50	51-60	Over 60	All	Below 30	31-40	41-50	51-60	Over 60	All	Below 30	31-40	41-50	51-60	Over 60
Did “Organizational Image” improve?	45.3	15.4	40.6	43.8	51.7	42.9	22.1	38.5	18.8	25	19	14.3	23.6	46.1	40.6	31.2	29.3	42.8
Did “Environmental Awareness “ improve?	24.6	15.4	20.6	24.5	24.1	42.9	9.7	7.7	8.8	14.3	5.2	14.3	65.7	76.9	70.6	61.2	70.7	42.8

Table 8: Occupants’ assessment of organizational image and environmental awareness by age group

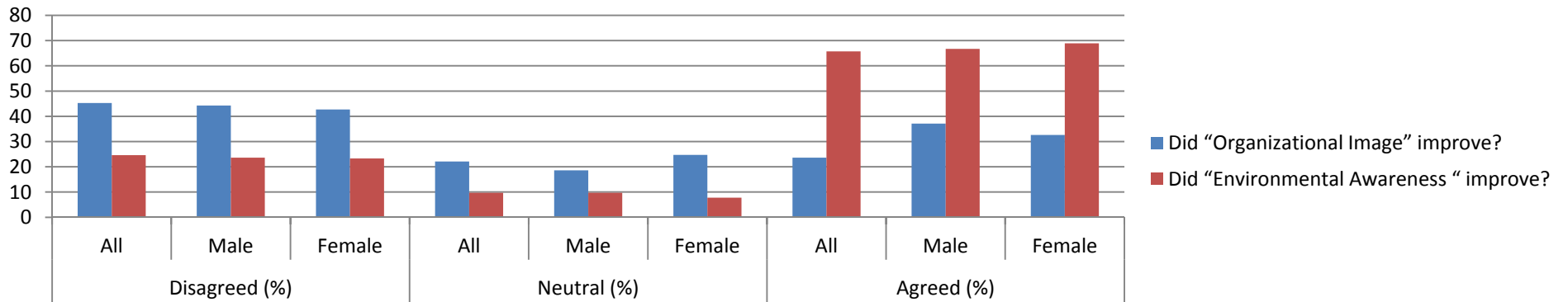


Figure 12: Occupants' assessment of organizational image and environmental awareness by gender

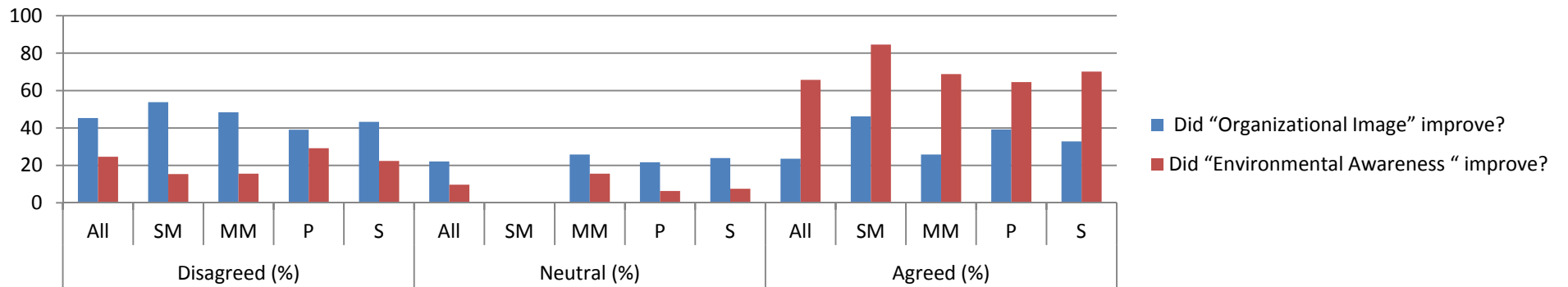


Figure 13: Occupants' assessment of organizational image and environmental awareness by job type

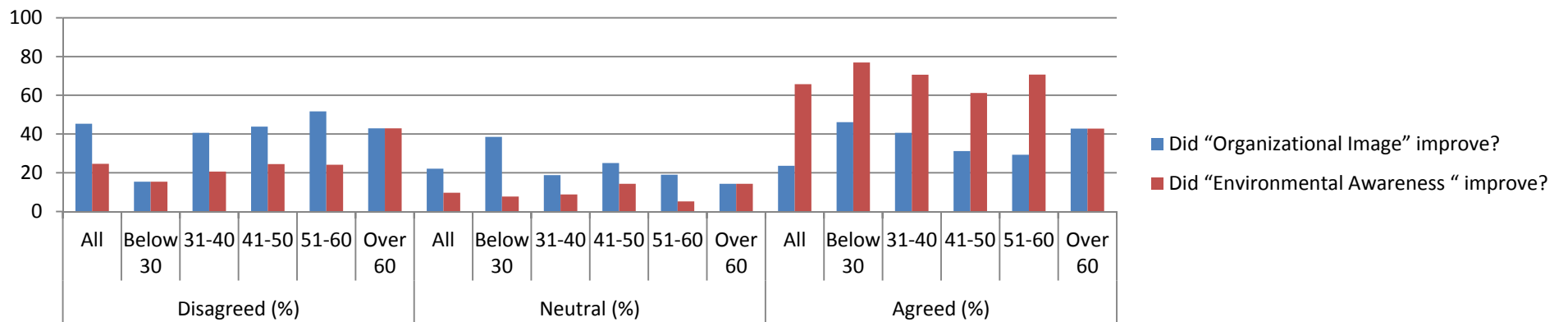


Figure 14: Occupants' assessment of organizational image and environmental awareness by age group

significant predictor variable [Table 11]. Likewise, a regression analysis with EA as dependent variable and workspace features showing significant correlations as predictor variables also showed no significant predictor variable [Table 11].

The occupants' assessments of most departmental space features also showed significant correlation with that of EA and OI [Table 10]. However, a regression analysis with OI as the dependent variable and workspace features showing significant correlations as the predictor variables returned no significant predictor variable [Table 11]. However, a regression analysis with EA as the dependent variable and departmental space features showing significant correlations as the predictor variables returned only 'departmental spaces are flexible' as a significant predictor variable [Table 11].

[Insert Tables 9–11 about here]

Table 12 and Figure 15 show the frequencies of responses of the occupants' satisfaction with workspace, departmental space and the building. More than 54% of the respondents were satisfied and just over 20% were not satisfied with their individual workspaces. More than 57% of the respondents were satisfied and over 21% were not satisfied with their departmental spaces. Finally, more than 69% of the respondents were satisfied and just over 11% were not satisfied with the building.

[Insert Table 12 and Figure 15 about here]

Table 13 shows the results of the regression analysis that used the occupants' assessments of individual workspace features or departmental space features as the predictor variables and the occupants' satisfaction with workspace, departmental space and the building as the dependent variables. According to the results, the occupants' assessments of individual workspace features explained about 62% of the variation in the occupants' satisfaction with workspace; the occupants' assessments of departmental space features explained about 65% of the variation in the occupants' satisfaction with departmental space; the occupants' assessments of individual workspace features explained more than 43% of the variation in the occupants' satisfaction with the building; and the occupants' assessments of individual departmental space features explained more than 39% of the variation in the occupants' satisfaction with the building. In all the models, there were several significant predictor variables as well.

[Insert Table 13 about here]

	Organizational Image	Environmental Awareness
amount of area in personal workspace fits needs	.195*	0.139
sufficient work surfaces in workspace	.152*	0.017
enough storage in workspace	.200**	.250**
furniture in workspace is sufficient	.296**	.285**
can enjoy outside view	.174*	0.067
can adjust workspace for needs	.303**	.269**
workspace helps accomplishing tasks	.198**	.184*
have enough privacy	.275**	.243**
can adjust workspace to increase privacy	.221**	.187*
conversations with co-workers cannot be overheard	0.129	.174*
phone conversations cannot be overheard	0.107	.177*
have enough privacy to do job well	.255**	.276**
have enough natural light in workspace	0.111	.156*
workspace is not too bright	.165*	.188*
lighting at desk helps job	.323**	.330**
have enough fresh air in workspace	.202**	.240**
happy with air quality	.258**	.273**
not too hot in workspace	.199**	.238**
not too cold in workspace	.209**	.225**
air not too dry in workspace	.283**	.320**
*. Correlation is significant at the 0.05 level (2-tailed).		
** . Correlation is significant at the 0.01 level (2-tailed).		

Table 9: Correlations between occupants' assessment of organizational image and environmental awareness with that of workspace variables

	Organizational Image	Environmental Awareness
can socialize in corridors/circulation areas	.268**	0.128
can socialize in lounge/breakroom	0.12	0.088
can socialize in coffee/snack bar	0.129	0.098
building provides opportunities for informal conversation	.330**	.303**
people I need to work with are close to my work area	.158*	.181*
shared spaces for teamwork/impromptu meetings	.401**	.354**
have no difficulty finding people needed to get work done	0.105	0.07
can choose where I get work done in bldg.	.186*	.151*
have easy access to equipment	.273**	.293**
do not have to go out of way to get info from co-workers	.250**	.218**
support equipment is convenient to workspace	.235**	.273**
layout of departmental workspace supports teamwork	.384**	.415**
layout of department supports impromptu meetings	.372**	.354**
office does not lack informal meeting spaces	.336**	.269**
conference and/or training rooms support tasks	.233**	.282**
conference spaces available when needed	.270**	.222**
conference spaces have suitable sizes	.242**	.325**
departmental spaces are flexible	.346**	.422**
** . Correlation is significant at the 0.01 level (2-tailed).		
* . Correlation is significant at the 0.05 level (2-tailed).		

Table 10: Correlations between occupants' assessment of organizational image and environmental awareness with that of departmental space variables

	Dependent and Predictor Variables	Model Summary			ANOVA	
		R	R Square	Adjusted R Square	F	Sig.
Regression Model 1*	Dependent variable: Organization Image Predictors: Individual Workspace Variables	.501	0.251	0.156	2.644	.001
Regression Model 2*	Dependent variable: Environmental Awareness Predictors: Individual Workspace Variables	.488	0.238	0.144	2.519	.001
Regression Model 3*	Dependent variable: Organization Image Predictors: Departmental Space Variables	.530	0.281	0.211	4.008	.000
Regression Model 4**	Dependent variable: Environmental Awareness Predictors: Departmental Space Variables	.516	0.266	0.201	4.096	.000

*Regression model with no significant predictor variables

**Regression model with one significant predictor variable

Table 11: Summary of the regression models with different environmental features as the predictor variables and organizational image or environmental awareness as the dependent variable

	Disagree (%)	Neutral (%)	Agree (%)
Satisfied with workspaces	20.1	25.1	54.8
Satisfied with departmental spaces	21.6	21	57.4
Satisfied with the building	11.3	19.2	69.5

Table 12: Occupants' responses to satisfaction related questions

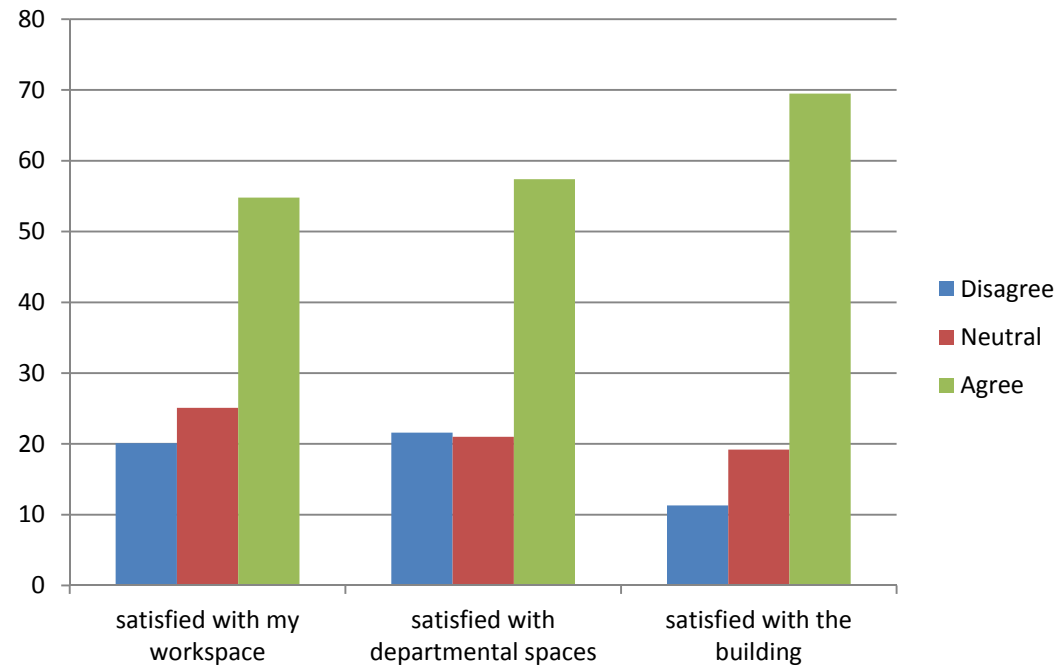


Figure 15: Occupants' responses to satisfaction related questions

Tables 14 and 15 show the results of the regression analysis that used the occupants' satisfaction with individual workspaces, departmental spaces and the building as predictor variables and the occupants' assessments of EA and OI as dependent variables. In the regression models, 'satisfied with workspace' and 'satisfied with building' were shown as the significant predictor variables for the occupants' assessments of OI explaining about 32% of the variation in this dependent variable [Table 14], and 'satisfied with building' was shown as a significant predictor variable for the occupants' assessments of EA explaining about 29% of the variation in this dependent variable [Table 15]. However, 'satisfied with departmental spaces' was not significant in either of the two models.

[Insert Tables 14 and 15 about here]

DISCUSSION

The study showed that in general the occupants of this LEED-certified building assessed the individual workspace and departmental space features of the building favorably. However, it should be noted here that most occupants' assessed all the items related to privacy negatively in this building. This may be due to the fact that with the exception of a few enclosed individual workspaces most workspaces in the building are defined by low-height partitions. It should also be noted that regarding departmental spaces most occupants responded negatively to the question "can choose where they can get their work done". It is possible that this was an organizational issue more than a design problem.

The study also showed that the occupants agreed that this building had positive effects on EA, but not on OI, and their assessments of EA and OI remained similar across gender, age, and job type. These findings are interesting in light of the fact that organizations often feel that their buildings need to be environment-friendly in order to improve organizational image. In contrast, the findings of this study suggest that the mechanisms explaining EA and OI are different in this LEED-certified 'green' building. This is in spite of the fact that the correlation between EA and OI is significantly strong ($r=0.685$, $p=0.000$).

As the first attempt to describe the mechanisms of the occupants' assessments of EA and OI, regression models were developed with the occupants' assessments of EA and OI as the dependent variables and the occupants' assessments of workspace and departmental space features as the predictor variables.

	Dependent and Predictor Variables	Model Summary			ANOVA	
		R	R Square	Adjusted R Square	F	Sig.
Regression Model 1***	Dependent variable: "satisfied with my workspace" Predictors: Individual Workspace Features	0.814	0.662	0.619	15.31	.000
Regression Model 2***	Dependent variable: "satisfied with departmental spaces" Predictors: Departmental Space Features	.826	0.682	0.647	19.418	.000
Regression Model 3***	Dependent variable: "satisfied with the building" Predictors: Individual Workspace Features	.705	0.497	0.431	7.594	.000
Regression Model 4***	Dependent variable: "satisfied with the building" Predictors: Departmental Space Features	0.673	0.453	0.392	7.493	.000

***Regression models with several significant predictor variables

Table 13: Summary of the regression models with environmental features as predictor variables and satisfaction as dependent variables

Regression Model
 Dependent variable: Organizational Image
 Predictors: Occupants' Satisfaction

Model Summary			ANOVA	
R	R Square	Adjusted R Square	F	Sig.
0.572	0.327	0.315	26.876	0

Coefficients		
Variables	t	Sig.
(Constant)	-9.453	.000
satisfied with workspace	2.635	.009
satisfied with departmental spaces	.347	.729
satisfied with building	4.594	.000

Table 14: Summary of the regression model with occupants' satisfaction as predictor variables and organizational image as dependent variable

Regression Model
 Dependent variable: Environmental Awareness
 Predictors: Occupants' Satisfaction

Model Summary			ANOVA	
R	R Square	Adjusted R Square	F	Sig.
0.547	0.299	0.287	24.049	0

Coefficients		
Variables	t	Sig.
(Constant)	.786	.433
satisfied with workspace	1.624	.106
satisfied with departmental spaces	.520	.604
satisfied with building	4.816	.000

Table 15: Summary of the regression model with occupants' satisfaction as predictor variables and environmental awareness as dependent variable

Even though a large number of workspace features showed significant correlations with OI and EA, when they were used in the regression equation as the predictor variables none showed significant F statistics for OI or EA. Likewise, even though a large number of departmental space features showed significant correlations with OI and EA, when they were used in the regression equation as the predictor variables none showed significant F statistics for OI, and only 'departmental spaces are flexible' showed significant F statistics for EA (sig. = .019). These findings thus suggest that there may be no significant direct relationship between the occupants' assessments of individual workspace and departmental space features and the occupant's assessments of EA and OI.

As the second attempt to describe the mechanisms of the occupants' assessments of EA and OI, regression models were developed with the occupants' assessments of workspace and departmental space features as the predictor variables and their satisfaction with individual workspace, departmental space and the building as the dependent variables. According to the findings of these models, the occupants' assessments of individual workspace and departmental space features were the significant predictors of the occupants' satisfaction with workspace, departmental space and the building. Following this, another set of regression models that used the occupants' satisfaction with workspace, departmental space and the building as the predictor variables and the occupants' assessments of EA and OI as the dependent variables showed 'satisfied with building' as a significant predictor for EA (sig. = .000), and 'satisfied with workspace' and 'satisfied with building' as the two significant predictors for OI (sig. = .009 & .000, respectively). These findings thus suggest that there may be some indirect relationship between the occupants' assessments of individual work space and departmental space features and the occupant's assessments of EA and OI through the occupants' satisfaction with individual workspaces and the building. In other words, the occupants' assessments of individual workspace and departmental space features may affect the occupants' satisfaction with individual workspace and the building, which may then affect the occupants' assessments of EA and OI.

CONCLUSION

Based on the statistical analyses of the data collected from 175 occupants of a Gold-level LEED-certified building using a questionnaire instrument, this study found no evidence for direct relationships between the occupant's assessments of individual workspace and departmental space features and their

assessments of EA and OI. The study, however, found some evidence for indirect relationships showing that the occupant's assessments of individual workspace and departmental space features had affected their satisfaction with individual workspaces and the building, which then affected the occupants' assessments of EA and OI. A summary of the study findings is provided in [Figure 16](#).

[Insert [Figure 16](#) about here]

Regarding the issue whether the occupants' of this LEED-certified building was "gray" or not, the findings of this study found that the occupants certainly appreciated the environmental design features of the buildings. These features had played an important role in determining how satisfied the occupants were with individual workspaces, departmental spaces, and the building. These environmental design features also made the occupants more environment-conscious, even though these features did not help improve their assessment of organizational image. In other words, even in a case where the "green" building and the organization that occupies it are treated as an integrated system with the occupants being aware of the environmental-friendliness of the building, the building may not help improve the occupants' assessment of organizational image.

In the context of heightened demands for green buildings, this study may thus offer a lesson for organizational leaders who would like to use green buildings to improve OI and/or EA. They should note that while providing "green" workspaces and buildings that satisfy occupants may help improve EA, there is no guarantee this may also help improve OI. In contrast to the suggestion made in the literature, they should further note that the mechanisms describing EA and OI could be very different in any given case with the qualification that OI of an organization might depend more on issues unrelated to the environmental features of a green building than EA of the organization might. In future, there will be a need to replicate this study to see if its findings hold true for other green buildings as well.

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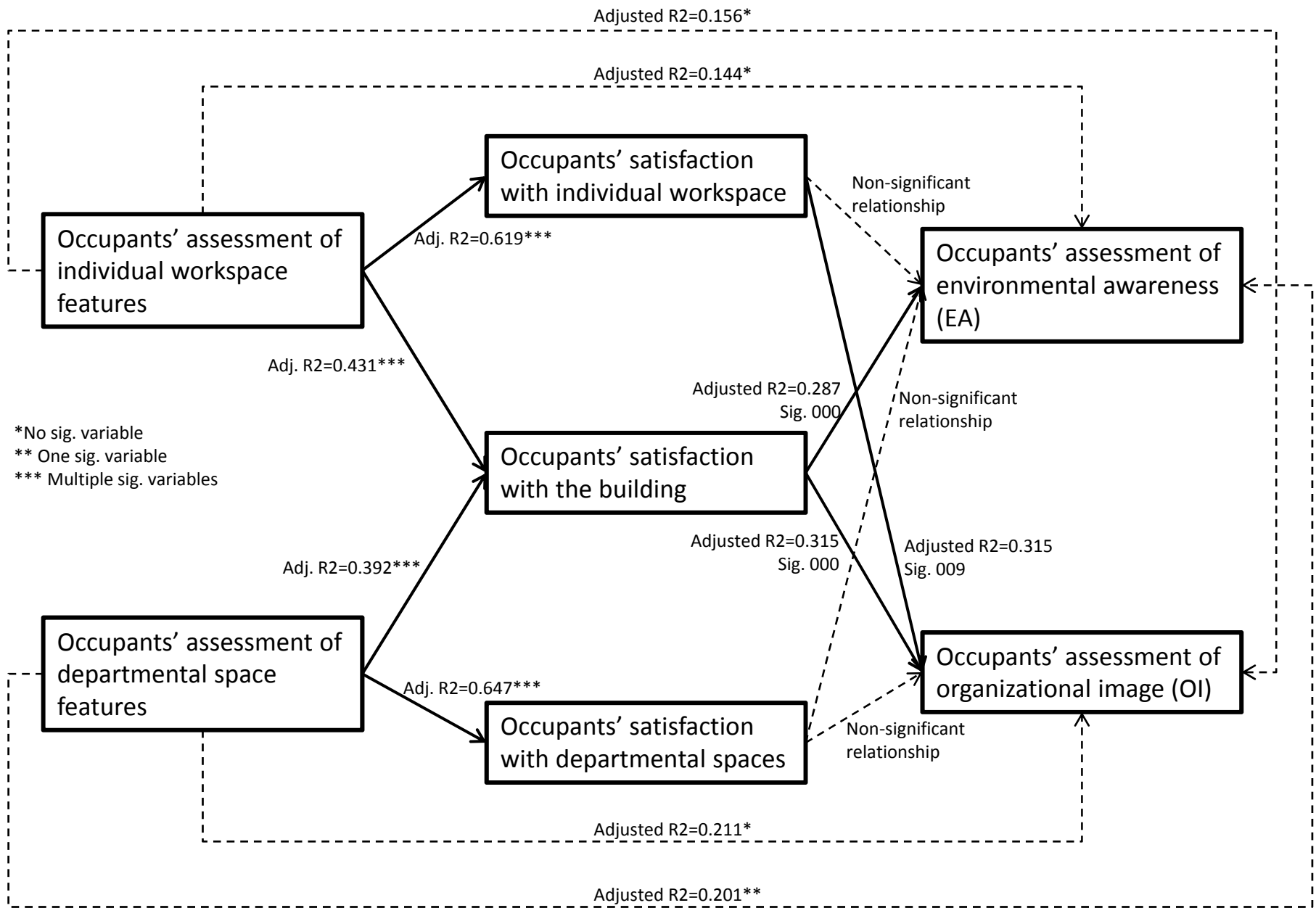


Figure 16: Summary findings

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