An Assessment of LEED Certification's Impact on Net Rental Rates for Commercial Office Space in Toronto, Ontario

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Abstract--**With the impact that buildings have on the environment, it is important to understand what barriers are preventing or slowing investment in socially and environmentally responsible property. The present study was conducted to determine whether LEED certification has a significant impact on the market value of office buildings in Toronto, Ontario – value determined by the average net asking rent for each building. For some 68 subject and control buildings, we matched information on the net asking rent for 16 LEED certified (subject) buildings to 52 otherwise comparable properties (control buildings). Using ordinary least squares (OLS) analysis, we looked to find what relationship exists between net asking rent and the LEED label. Controlling for other variables historically shown to have an impact on property value, we expected the results of this study to determine whether there is a business case for LEED certification in the downtown Toronto office market.**

I. BACKGROUND AND MOTIVATION

Interest in the construction and occupancy of buildings that are ecologically benign has gained momentum. One indicator of the interest in design of buildings that consider the natural environment is the exponential growth in membership in the green building councils in Canada and the United States. Although the numbers indicate an increased interest in green construction and sustainable property development, the reality is that up until 2005 Canada had seen less than 200 buildings become registered for LEED [18]. [1] There are a number of stakeholders involved in Canada's slow rate of adoption of green/sustainable building standards, and the specific issues faced by these stakeholders and the relationships between these groups has been the focus of recent studies.

The majority of prior studies provide anecdotal evidence in the form of engineering estimates, case studies, and surveys of opinion; most of which have been performed on markets outside of Canada (particularly the US, UK, and Australia). It is therefore a motivation for this research to contribute to the literature by investigating the adoption of LEED in Canadian markets, specifically in Toronto, Ontario.[2]

II. A BRIEF PRIMER ON LEED

LEED is a third-party certification program and an internationally accepted benchmark for the design, construction, and operation of high performance green buildings. [3] It provides building owners and operators the tools they need to have an immediate and measurable impact on their buildings' efficiency and environmental impact. The Canada Green Building Council (CGBC) administers the development and ongoing improvement of the LEED rating systems.

Building types that are eligible for certification include – but are not limited to – offices, retail and service establishments, institutional buildings (e.g., libraries, schools, museums and religious institutions), hotels and residential buildings of four or more habitable stories. In addition, the CGBC has developed separate rating systems that take into account the specific needs of: new construction, core and shell, commercial interiors, existing buildings, homes, and neighborhoods. For any project that falls under one of these categories, LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development; water efficiency; energy efficiency; materials selection; and indoor environmental quality.

Despite the development of several versions of LEED designed to account for the challenges faced by those looking to build and retrofit buildings in Canada, the rate of adoption has been slow when compared to adoption of LEED elsewhere. In order for LEED to be widely adopted in Canada, compelling empirical evidence of the benefits it offers needs to be provided.

III. RESEARCH QUESTIONS AND OBJECTIVES

As there are a number of variables that contribute to building value, it is important to take these factors into account when trying to determine what impact, over and above all other factors, LEED certification has on office rents. The objective is to effectively separate LEED's contribution to net asking rent from that contributed by all other variables. Thus, the research question is: Does LEED certification matter in downtown Toronto, Ontario's office rental market yet? In response to this question, the objectives of this research are to:

[1] 2014 saw 537 LEED certifications in Canada.
[2] Of the 2,050 LEED certifications in Canada as of 2014, 843 (41%) are in Ontario.

[3] A green building is a property that uses resources efficiently, reduces waste and CO_2 emissions and provides superior indoor air and other qualities. A green value is the value obtainable by a green building over and above the market compared to a non-green peer group. Therefore the green value is an integral part of the overall market value.

1) Identify the key stakeholders involved in the market adoption of socially responsible property initiatives (SRPI) such as LEED.
2) Identify the factors inhibiting and motivating market adoption of SRPI by those stakeholders shown to be a catalyst to adoption by the rest of the market.
3) Analyze the impact of LEED labeling on those factors affecting market adoption of SRPI by key stakeholders.

Answering the research question requires the identification of key stakeholder groups, factors influencing their adoption of LEED certification, and climate for market adoption of LEED certification in Toronto, Ontario. Although the development of the models will be generic in nature, for the purpose of this study, the setting will be downtown Toronto, Ontario. Therefore, it is important to note that although the model specifications can be used in future studies, the results are applicable to downtown Toronto, Ontario, and may not generalize to other markets.

IV. PRIOR THEORY AND EVIDENCE

A review of literature provides an examination of the issues faced by key stakeholder groups in their adoption of LEED standards. Included in this examination are issues faced by Valuers, Investors, Developers, Contractors, and Occupiers.

A. Valuers

As the stakeholders responsible for assessing a property's market value, the willingness and ability of valuers to attribute a portion of a building's value to its green attributes will affect the determination of its worth to other stakeholders and ultimately their willingness to adopt green standards. The link between valuation and action taken by other stakeholders has been shown in prior research of building energy performance, which has shown that unless valuation professionals appreciate the importance of low energy offices, the likelihood of certification having any impact in a reasonable time is small [11].

That specific building characteristics contribute to property value plays an important role in the decision of investors and developers as to the degree to which they will pursue specific building attributes. Traditionally, the main issues that are taken into account when determining whether a building is of 'investment quality' are location, condition, design, size, and quality of the floor space, amenities and service, adaptability to different tenant's requirements, and infrastructure (transport and communications) [11, 22]. In assessing the value contribution of these individual attributes valuers search for and analyze comparable market data.

Finding comparable data is a basic fundamental of property valuation – not just when applying the comparison approach.[4] This analyzed data is then used to derive input figures that could be used within the valuation process. The essential rule to ensure that the outcome is correct is therefore: to compare apples with apples. Comparables must have the same building characteristics in terms of location, technical equipment, condition, and tenant profile among other attributes, and also with respect to green features (e.g. energy efficiency level).

In addition to the complexity of including green features into the characteristics to be evaluated in the property valuation process, there are also a number of issues associated with the tools used to rate a building's 'greenness.' Within the rating tools, particularly design oriented tools like LEED, Green Star and BREEAM where certification is assessed over a number of environmental categories, the ability to compare properties is inherently difficult; as the achievement of certification can be accomplished through various pathways and often these are not openly addressed or advertised in the marketplace. Therefore the lack of transparency in how buildings achieve their certification levels prevents valuers and appraisers from being able to compare properties on a 'like for like' basis as required by valuation statute [31].

B. Developers

In general, in socially responsible investing, few companies are eliminated or included in funds or indices because of the products they produce. Exceptions include guns and tobacco. But generally, companies that do a good job with social, environmental and governance issues regardless of their products are included. The focus is on how they conduct their business and produce their products, not on what products they produce. However, with real estate, companies or funds or trusts can be differentiated both in terms of how they produce their products and the types of products they produce [26].

Both real estate developers and institutional investors are understandably uncertain about how far to pursue environmental investments, since the economic rationale for the development of sustainable buildings is based almost entirely on anecdotal evidence [7]. In addition, because buildings can be sources of environmental degradation during their construction, operation, and demolition, it is difficult for developers to determine what the most cost-effective methods of greening their projects are. According to [16], although environmental performance cannot be measured on a monetary scale it can be quantified using the evolving, multidisciplinary approach known as environmental life-cycle assessment. This method of assessment is also known as the cradle-to-grave approach as it takes into account the impact that the construction, operation, and eventual demolition of a building will have on the natural environment.

When considering LEED for a building project, it is crucial first to determine which points are achievable by the

[4] The comparison approach adjusts the prices of the comparable transactions according to the presence and degree of characteristics that influence value.

project. From there, an understanding of the potential costs of each achievable point can be developed [19]. The best and most economically sustainable designs are ones in which the features are incorporated at an early stage into the project, and where the features are integrated, effectively supporting each other [19].

Once achievable points have been determined and the most economical design has been implemented the costs can be determined. At this point developers and investors could attempt to determine the precise 'green premium' for a given project, but this is often very difficult for several reasons.

Developers typically only issue specifications and costs for the designed building, not for other green options. Individual green items are sometimes priced out in comparison to non-green ones, but this is not the norm and does not provide a basis for cost comparison between green and conventional whole building design. Frequently green buildings being built today are showcase projects that may include additional and sometimes costly 'finish upgrades' that are unrelated to greenness but that nonetheless are counted toward the green building cost increase.

The design and construction process for the first green building of a client or design/architectural firm is often characterized by significant learning curve costs, and design schedule problems such as late and costly change orders. The relative newness of green technologies and systems can make designers, architects and clients conservative when using them. They may oversize green building systems and not fully integrate them into the building, thereby reducing cost savings and other benefits. Similarly, cost estimators may add uncertainty factors for new green technologies they are not familiar with, and these can compound, further inflating cost estimates [14].

C. Occupiers

The common use of triple net leases is a disincentive to investments that reduce operating costs because owners and developers do not receive direct benefits unless tenants agree to higher lease rates [2]. When determining to what extent investors and developers should bear additional costs in efforts to design and construct more socially responsible property it is important to keep in mind that market factors dictate the rental level, but business productivity ultimately dictates the occupier's ability to pay [30]. It is therefore important to consider the economic impact green buildings have on occupiers. As noted by [8], economic benefits may result from: (1) reduced health care costs; (2) reduced sick leave; and (3) a reduction in time when health effects diminish performance of workers while they are at work. The potential value of these employee-related benefits has been estimated in research conducted by Carnegie Mellon University for the General Services Administration in 1999. That research found that costs associated with employees amounted to 78 percent of total operations costs, while costs connected directly to the built environment – rent, operations and maintenance, and office moves – made up only 9 percent [24]. Many of the cost/benefit studies conducted in the past have used these figures in attempts to estimate the economic gains attainable from improvements in the indoor environment offered by green buildings. However, even with the best of the information currently available, there is a high level of uncertainty with these estimates of the health and associated economic gains attainable from improvements in the indoor environment. In general, the largest source of uncertainty is the degree to which health effects could be reduced through practical changes in building design, operation, and maintenance [8]. As noted by [18], there is limited statistically sound research into the benefits of green buildings, particularly in the area of productivity, which could be a key element in the acceptance of green buildings. In order for occupiers to actively seek out green buildings, concrete evidence of the economic benefits derived from green attributes must be presented.

D. Investors

One of the key barriers identified by the Intergovernmental Panel on Climate Change to realizing sustainable real estate's potential was the availability of financing [12]. As property owners and debtors, real estate investors can influence how property-related issues are addressed. They can purchase and promote new buildings that are located and designed to create fewer negative and more positive impacts, and they can address issues through how they manage and refurbish their existing portfolios [27].

Reference [28] determined that the strongest drivers of responsible property investing were conventional considerations such as concern for risk and return and opportunities to outperform the market. However, for real estate investors, hard evidence on the financial performance of green buildings is limited. To persuade property owners, developers and investors in the global marketplace of the benefits of eco-investment, the payoff from investment in green buildings needs to be identified in that same marketplace [7].

Beyond the factors impacting project cost, one of the most important considerations for investors is how they go about their cost/benefit calculations. The single most important justification mechanism for managers striving to make the case for sustainable buildings is life cycle costing, which is a modification of benefit/cost analysis that focuses more on cost reductions over time than near-term financial benefits. Nearly all of the benefits accrued with green building occur over the economic or design life of the building with a typical time horizon of 20-25 years [29]. Beyond the 1-3 year time frame, however, few decision-makers believe in the predictions of the cost of energy, or that they will still own the building and be accruing savings from the innovation [17].

In addition to the long payback periods faced by investors, there is also a lack of guidance on what constitutes a green building. From a stock market perspective, the lack of a clear definition on what constitutes a green building is a significant

issue. The market likes to benchmark, but there is no one clear benchmark of green or sustainable property or development [20]. One way around this issue is in assessing the performance of groups of buildings.[5] If an index of performance of existing buildings correlating financial return and sustainability criteria is realized, then a market transformation will take place [30].

V. STUDIES OF RESPONSIBLE PROPERTY INITIATIVES

Investigations attempting to provide a complete cost/benefit analysis of socially and environmentally responsible property initiatives (such as LEED) have two major flaws that inhibit their ability to provide motivation for stakeholders to invest in socially and environmentally responsible property. First, they are fraught with assumptions that are backed by engineering calculations and surveys of opinion rather than factual evidence. Second, the costs and benefits are based on a number of factors that may not be applicable to other projects.

The study performed by [14] is one of the most heavily cited cost/benefit analyses ever performed on green buildings. One of the main conclusions of this study was that green buildings are more comfortable and healthier for building occupants, in addition to supporting increases in productivity. Therefore they should be in greater demand than conventional buildings: achievable rents should be higher and vacancies lower. Although the study does not prove there is a net financial benefit associated with green buildings, they do note that "a study that tracks green buildings in the marketplace could confirm or deny this" [14].

When buildings are tracked in the marketplace, occupancy (or vacancy) rates are commonly used as a portmanteau indicator of market conditions [9]. The vast majority of the academic literature on vacancy levels has been on modeling regional or metropolitan levels typically focusing on their explanatory power in rent determination at the market level. Not surprisingly, these studies have tended to find a positive relationship between rent and occupancy rates. Essentially both rent and occupancy rates are analyzed as jointly determined and are modeled as outcomes of the interaction of the same supply and demand conditions [9].

So, although there have been a number of recent studies measuring market adoption of socially and environmentally responsible property initiatives, the majority of existing studies have focused on markets outside of Canada. Of the studies that have focused on Canadian markets, none have offered concrete evidence as to the impact on value of socially and environmentally responsible property initiatives such as LEED labeling.

A review of the literature indicates that property owners and investors are the stakeholder group with the power to decide how building issues get addressed, and should therefore be a focus in promoting market adoption of LEED. Furthermore, given that this stakeholder group is predominantly concerned with the financial implications of their decisions. That being the case, a second round of literature was reviewed to determine what factors have an impact on return on investment for property owners. The factors that have been shown to be significant determinants in office price modeling are outlined in Table 1.

TABLE 1: STUDIES OF FACTORS IMPACTING OFFICE RENTS

Author	Region	Sample size	Dependent variable	Independent variables found to be significant
[5]	Los Angeles metropolitan area	105	Average 1974 asking rent	size, age, number of floors, internal parking, prestigious address, property tax, air quality, amount of office space within a two block radius, distance by road to nearest motorway junction, average community time for employees
[13]	Chicago central business district	139	Average 1978 asking rent	existence of 'good' architecture, distance from CBD, public parking, age, size, number of floors, availability of conference facility
[4]	Champaign- Urbana, Illinois	24	Average 1979-1980 asking rent	age, minimum lease term in years, crow fly distance to the CBD, crow fly distance to a shopping centre, average unit size, average number of units per floor
[1]	Chicago central business district	29	Actual transacted lease values (incorporating lease terms) within a building from 1980-1983	size of building, size of each unit, lease terms, loss factor (proportion of area rented but not possible to use), position within the building, location with respect to centre of CBD
[10]	Baton Rouge, Louisiana	675	Asking rents of office units from 1985-1988	location, building type, size, the year in which the property was let
[23]	Chicago	543	Asking rents and the discounted rent over the period of a 15 year lease	age, size, parking, internal restaurant, internal bank, location outside the CBD (but not subsectors within the CBD)
[6]	Glascow, Scotland	477	Asking rents 1994-1995	size, age, location, air conditioning, acoustic tiling, carpeting cellular layout, double glazing, internal parking, raised floors, tea preparation area

[5] There are a number of ways that buildings may be evaluated in groups. Some examples include portfolios, trusts, or even indices.

Overall, location, age and size were the variables found to most consistently explain the variation in rents in these studies. Although each study shows a variety of building attributes to be significant, they appear significant on a less consistent basis than location, age, and size because the value attributed to them is unique to the particular office market studied. It is therefore important to note that, although previous studies can provide us with insight into which combinations of variables have been proven significant in past studies for other markets, their results are not necessarily transferable to the office market in downtown Toronto, Ontario. At best, a review of the literature allows us to develop a list of principal determinants of rent for local market areas that can then be used to build a model for downtown Toronto, Ontario. With knowledge of those variables that have been proven significant in past studies, quantitative analysis can now be used to determine what a model explaining the variance in office rents would look like, and whether LEED would be included in that model.

VI. RESEARCH METHODS

Information related to specific building variables for both LEED-labeled buildings and their comparables was obtained from the Altus InSite database and Toronto City Hall's property assessment database.

In keeping with the approach used in a number of building studies conducted in U.S. markets [7, 9, 21, 32], OLS analysis was used to develop a model that best accounts for the variance in office rents and, ultimately, indicate whether LEED would be included in that model.

OLS is a method for estimating the unknown parameters in a linear regression model. This method minimizes the sum of squared vertical distances between the observed responses in a dataset, and the responses predicted by the linear approximation. The resulting estimator can be expressed by a version of the following formula: $Y= X\beta + \varepsilon$ where Y is an n x 1 vector of observations on the regressand (i.e., the average net asking rent for a building), X is a n x k matrix of observations of the regressors (e.g., building age, building class, existence of indoor parking, etc.), β is a k x 1 vector of unknown coefficients, and ε is an n x 1 vector of independent and identically distributed normal disturbances with zero mean and variance σ.[2]

The goal of this analysis is to develop a model that is best able to account for the variance in net asking rents (our regressand) and determine whether LEED is a significant contributor to a model accounting for the variance in office rents in downtown Toronto, Ontario.

A review of the literature allowed a refined list of variables to be included in the model. As the variables that typically have a significant influence on property value have been established, they will be included in this study in conjunction with LEED certification to determine if LEED certification should be included in a model seeking to explain the variance in net asking rents.

From these interconnected evaluations, an assessment of LEED-labeling's impact on property value is made. The baseline building characteristics for properties included in this study provides a base for the generalizability of results and their applicability in demonstrating the impact of LEED-labeling across various scenarios. Each building characteristic will hold certain weight and in light of that, the various changes introduced (and their effects) will make it possible to evaluate the building as a whole. The evaluations will culminate in a valuation report that addresses the impact of LEED-labeling on net asking rent.

The City of Toronto has 116 million square feet of office space, nearly three quarters of which is in the central business district. In addition, Toronto's downtown core is one of the most populated with LEED certified buildings in Canada [3], providing a sufficient sample size that makes it appealing for investigation.

The buildings included in this study are taken from two areas of Toronto, downtown Toronto and Northern Toronto. Two areas are used because, as noted earlier, the comparison of two submarkets in this study will provide for an accounting of various location characteristics that may impact the value of LEED in any given submarket but are not explicitly accounted for in this study. The main office market is located in downtown Toronto, also referred to as the central business district (CBD) of Toronto, with a total office inventory of 69,060,133 square feet [15] and an average gross rent[6] of $34.52/square foot. For the purposes of this study CBD will refer to the area bounded by Bloor Street to the North, Lake Ontario to the south, the Don River to the East, and Bathurst Street to the West. The second group of buildings included in this study fall outside of the CBD – are approximately 13 kilometers North of 200 Bay Street[7] and are within a 3.5 kilometer radius of one another. A total of 21 buildings were taken from Northern Toronto (four of which are LEED certified), while 47 buildings were taken from Toronto's CBD (12 of which are LEED certified).

A. Data

A sample of 24 LEED certified office buildings was obtained from the list of Canadian LEED certified properties [3], and the list of 90 non-LEED comparable properties was obtained from Toronto City Hall's building information database. Information related to building class,[8] total office area, year built, parking ratio, direct available rate,[9] direct

[6] Gross rent is the monthly rent charged to occupy a premise that includes all operating costs (i.e., utilities, maintenance, taxes, etc.)

[7] For the purposes of this study 200 Bay Street is considered to be the center point of the most prestigious office area in Toronto.

[8] The Building Owners and Managers Association classifies buildings based on a number of building and location characteristics as well as the ability to attract tenants at, above, or below market rents for the area. Based on these characteristics, buildings are subjectively ranked Class A, B or C.

[9] The direct available rate, otherwise known as the vacancy rate is the percentage of all units that are unoccupied or not rented at a given time.

asking rate,[10] and total additional rent[11] were all obtained from the Altus InSite database.

Additional information related to direct asking rates and total additional rent that was not available from the database was obtained through phone calls to building leasing agents.

This study limited the inclusion of buildings to those that are office buildings in excess of 30,000 square feet and located within the study area. In addition, those buildings that were owner-occupied were eliminated from the study. For each LEED building included in the study attempts were made to include at least three non-LEED certified, but otherwise comparable properties. Ultimately, study specification and limitations related to data availability led to the inclusion of 16 LEED certified buildings and 52 non-LEED certified comparables.

Attempts to obtain information related to actual transacted rents through contact with a number of landlords, brokerage and research firms were unsuccessful. As a proxy, asking rents will be used as a measure of value. Although there was some concern about using asking rents rather than actual transaction price, [6] found initial asking rent and final transacted rent to have a correlation coefficient of 0.98, showing that the two variables are highly correlated and therefore providing justification for the use of asking rents as a proxy measure of value.

B. Variables

The hedonic price model is estimated using regression analysis in which the dependent variable is asking rent. There are a total of 12 variables, listed in Table 2, which describe the physical and location characteristics of each building.

Total office area relates to the capacity of the building. Although parking is the only variable related to physical structure, age and building class have been included as proxies for other variables related to a building‘s structure. Direct available rate and sublet area rate will serve as proxies to annual building vacancy rates. The direct asking rate serves as a proxy to actual transaction prices, and total additional rent is also included due to its impact on the gross rent that tenants pay.

The variables included in this study, although not an exhaustive list of building variables, are thought to comprise a comprehensive list of those variables believed to have a significant effect on net asking rent. Many building structure characteristics are excluded, although it is possible to argue that they are accounted for with the building class and age variables. Many location specific variables were excluded due to the clustering of the sample buildings included in the study. In their place, a calculation of each building‘s proximity or ‘crow fly’ distance to the CBD center point (200 Bay Street) was used to account for any variation in office rents related to building location– variance usually associated with a prestigious address. 200 Bay Street is at the heart of Toronto‘s financial district, an area predominantly occupied by financial institutions and large professional practices and commands top rents for office space, providing justification for its use as the center of the CBD in this study.

TABLE 2: VARIABLES AND DESCRIPTION OF VARIABLES

Variables	Variable code	Measure	Description
LEED certified	LEED	Dummy variable	Indicates whether or not a building is LEED certified
“crow fly” distance from 200 Bay Street	CROW_FLY	Number	Euclidian distance from the subject property to 200 Bay Street
Office Class A	CLASS_A	Dummy variable	Is it a Class A office building, if yes=1
Office Class B	CLASS_B	Dummy variable	Is it a Class B office building, if yes=1
Office Class C	CLASS_C	Dummy variable	Is it a Class C office building, if yes=1
Total office area	OFFICE_AREA	Number	Total building square footage
Building age	AGE	Number	The age of the building in years
Parking ratio	PARKING_RATIO	Number	The number of parking stalls per 1,000 square feet of leasable office space
Direct available rate	DIRECT	Number	The percentage of the building space available for lease from the landlord at the time of study
Sublet area rate	SUBLET_AVAILABLE	Number	The percentage of the building space available for lease from an existing tenant at the time of study
Direct asking rate	NET_RENT	Number	The asking rent (per square foot)
Total additional rent	ADDITIONAL_RENT	Number	The additional charges (per square foot) above and beyond asking rent

[10] Direct asking rate, otherwise known as the net asking rate, is the amount the landlord hopes to receive from a rental property after deducting costs such as taxes, insurance, utilities, etc.

[11] Additional rent is the portion of rent the tenant pays under the lease to cover expenses of the landlord.

TABLE 3: BINARY CODING OF BUILDING CLASS

	CLASS_B	CLASS_C
Office Class A	0	0
Office Class B	1	0
Office Class C	0	1

VII. RESULTS

Before conducting the regression analysis, a correlation matrix was developed to determine each variable's level of explanatory power (Table 4). An OLS analysis was conducted to determine which compilation of variables creates the equation that best accounted for the variance in net asking rents. In the analysis, the independent variable with the highest partial correlation coefficient to net asking rent is entered first into the model. This process is continued by adding the variable with the next highest partial correlation coefficient to the model and the adjusted R^2 for the new model is evaluated to compare its explanatory power to that of the previous model. This process is continued until all of those variables with a partial coefficient significant at the 0.05 level have been added to the model to assess their impact on the model's explanatory power. In addition, as new variables are added to the model, previous variables are removed from the equation if their significance level falls below the 10 percent critical value.

In order to gain some understanding of the relationship between LEED and the other coefficients included in the matrix, we will analyze the correlation between them. The two coefficients most heavily correlated with LEED are CLASS_A and CLASS_B, with correlation coefficients of .394 and -.367 respectively. These two variables having a correlation with LEED that is significant at the 0.01 level is likely the result of all LEED certified buildings included in the sample being Class A buildings, thereby resulting in a strong positive correlation with CLASS_A and a strong negative correlation with CLASS_B. CLASS_C is also negatively correlated with LEED, but not to the same degree as CLASS_B, this is likely due to the fact that there were far fewer Class C buildings included in the study than there were Class A and B.

Next we see that ADD_RENT and OFFICE_AREA are positively correlated with LEED, with correlation coefficients of .240 and .230 respectively. Office area is positively correlated with LEED certification because the buildings in the sample that were LEED certified tended to be larger buildings. It follows that larger office buildings are also those that are more likely to have a large amount of common area and more amenities, thereby increasing the amount of additional rent charged to tenants.

The remaining coefficients that are positively correlated with LEED are PARKING_RATIO and SUB_AVAIL, with correlation coefficients of .190 and .025 respectively. These correlations tell us that LEED buildings may have more parking and more sublet space available, but given the low level of significance obtained by these correlations, any attempt to generalize these statements would be speculative.

TABLE 4: CORRELATION MATRIX

Correlations

	NET_RENT	LEED	CLASS_A	CLASS_B	CLASS_C	OFFICE_AREA	PARKING_RATIO	AGE	DIRECT	SUB_AVAIL	ADD_RENT	CROW_FLY
NET_RENT	1	.193	.489**	-.428**	-.198	.566**	.616**	.089	.214	-.032	.873**	-.608**
LEED		1	.394**	-.367**	-.102	.230	.190	-.197	-.060	.025	.240	-.104
CLASS_A			1	-.931**	-.260*	.390**	.368**	-.196	.001	-.069	.489**	-.110
CLASS_B				1	-.110	-.348**	-.303*	.185	.008	.019	-.406**	.081
CLASS_C					1	-.144	-.201	.042	-.022	.137	-.256*	.085
OFFICE_AREA						1	.550**	-.089	.198	-.063	.650**	-.297*
PARKING_RATIO							1	.113	.135	-.230	.649**	-.455**
AGE								1	-.109	.058	.031	-.171
DIRECT									1	-.038	.172	.060
SUB_AVAIL										1	.015	-.152
ADD_RENT											1	-.576**
CROW_FLY												1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

We then have those remaining coefficients that were negatively correlated with LEED, those being AGE, CROW_FLY and DIRECT, with correlation coefficients of -.197, -.104 and -.06 respectively. These figures tell us that LEED buildings tend to be newer properties, likely situated near the center of the CBD, with lower than average vacancy. Again, however, the low level of significance of these obtained by these correlations makes it difficult to generalize these statements beyond the study sample.

Finally, we look at the .193 correlation between NET_RENT (our dependent variable) and LEED. Although this correlation is near significance, possibly telling us that LEED buildings obtain higher net rents, this could also be the result of multicollinearity with other variables that have high positive correlations with NET_RENT.

Now that the relationships between LEED and the other coefficients considered for the model have been analyzed, we will now begin to build the model.

The first variable to be included in the model, with a partial correlation coefficient of .873, is additional rent. This initial model returned an adjusted R^2 of .757, with additional rent significant at the 99 percent critical value level. This is a very high adjusted R^2 and may be cause for concern that 'additional rent' might be drowning out the effect that other variables (including LEED) might have on net asking rent, especially when considering the high degree of correlation between additional rent and the other predictor variables. That being said, the process of adding and removing variables from the model based on their partial correlation coefficients and significance levels was continued until we arrived at a model consisting of ADD_RENT and CLASS_B.

The model produced an adjusted R^2 of .769, with ADD_RENT significant at the 99 percent critical value level and CLASS_B significant at the 95 percent critical value level.

The exclusion of many variables from the best model is explicable when we look at the relation of each to additional rent while taking into consideration the characteristics of the sample buildings. The first variable that was removed from the model was PARKING_RATIO, which has a partial correlation coefficient of .616 yet could still not be deemed significant in a model that already included ADD_RENT. As ADD_RENT is typically a composition of those costs associated with property taxes, common area maintenance and any other additional expenses the landlord may charge related to building maintenance and services; the greater the amount of common area a building possesses, the higher the additional rent will be. Those buildings with the greatest amount of common area in downtown Toronto happen to be located in the CBD, an area where reserved parking is rare and highly sought after. When linking the value placed on parking in the CBD with the higher additional rents in the area, it is understandable why the significance of parking may have been drowned out by the ADD_RENT variable.

As we go down the list of variables with high individual correlation coefficients we can see that the same effect was had on CROW_FLY and OFFICE_AREA, as these variables are affected by proximity to the centre point of the CBD. CROW_FLY is affected because it is actually a measure of building proximity to the centre of the CBD, while OFFICE_AREA is affected because the buildings in downtown Toronto with the greatest amount of office space are those in the centre of the city's CBD. The only other variable excluded from the model with a significant individual correlation to net asking rent was CLASS_A, which was excluded because it was replaced by CLASS_B which reduced its significance and provided a model with a higher adjusted R^2. The large changes in the regression coefficients produced by the inclusion of ADD_RENT in the model are an indication of multicollinearity. The same can be said for the relationship between CLASS_A and CLASS_B, however the multicollinearity that exists between these two variables was expected as they are both indicators of building class, but both were evaluated to see which contributed most significantly to the model.

In an attempt to reduce multicollinearity, a second stepwise regression analysis was performed that excluded ADD_RENT from the model. The first variable included in the new model was PARKING_RATIO, resulting in an adjusted R^2 of .370 with the parking ratio significant at the 99 percent critical value level.

Next, CROW_FLY was added to the model, returning an adjusted R^2 of .501 while both coefficients maintained significance at the 99 percent critical value level.

OFFICE_AREA was then included, increasing the adjusted R^2 to .552, and although CROW_FLY and OFFICE_AREA remained significant at the 99 percent critical value level, PARKING_RATIO's significance was reduced to the 95 percent critical value level.

When CLASS_A is added to the model we see PARKING_RATIO and OFFICE_AREA's significance reduced to the 90 and 95 percent critical value levels respectively, while CROW_FLY and CLASS_A are significant at the 99 percent critical value levels and the model's adjusted R^2 moves to .604.

Finally, CLASS_B is introduced to the model, but subsequently removed due to its negative effect on the significance of the other variables and adjusted R^2. Therefore, our best model is comprised of the coefficients PARKING_RATIO, CROW_FLY, OFFICE _AREA and CLASS_A, producing an adjusted R^2 of .604.

According to the correlation matrix, LEED certification's correlation with net asking rent is not significant at the .05 level, which would normally disqualify it from inclusion into the model, but regressions were still conducted to assess the impact of LEED on our best model's explanatory power. Ultimately, when LEED was introduced to the model all original model coefficients fell within their original significance levels, but LEED was not shown to be statistically significant (.528), pulling adjusted R^2 down to .600. It was therefore concluded that LEED certification should remain excluded as it did not improve the explanatory

power of the model.

VIII. CONCLUSIONS

This study contributes to the literature by assessing whether LEED certification has a significant impact on determining net asking rents in Canada's largest office market (Toronto, Ontario), an area where the financial benefit of obtaining LEED certification has not attracted sufficient empirical attention. Although this study did not find LEED certification to be statistically significant in explaining the variance in net asking rents, this study can be helpful in setting parameters for more advanced research on the impact that LEED certification has on net asking rents and other measures of property value. Given the high rate of adoption of LEED certification by landlords in markets across North America, this will continue to be a promising area of research.

The results of the study show that LEED certification has had no impact on the market value of the sample of office buildings in Toronto. This is a surprising result, given the growth in the number of LEED buildings in Canada. As LEED certification was observed to be correlated with prior characteristics of net asking rents – size, age, and location – it may be that LEED certification is simply part of the new normal expectations for premium office space. In which case it is not that LEED certification stands out, but the absence of it that will. Further, the industry is ruled by long-standing and slowly-evolving intuitions where the pack stays together – few leap ahead and few are left behind.

A. Implications for practitioners

This study provides directions for managerial practice. The study presents two main implications for landlords/developers that may be considering LEED certification for office buildings in the downtown Toronto area. First, given that the study did not find LEED certification significant in explaining the variation in net asking rents, it follows that practitioners looking to maximize building returns should be cautious in subscribing to LEED if the costs associated with achieving certification are significant or if the expectations are for LEED certification to improve profitability.

Second, if the financial draw for practitioners is associated with a reduction in operating expenses and not the marketing impact of a LEED label, then these building improvements can still be achieved without requiring the payment of various fees associated with the certification process. From this standpoint it may be beneficial for practitioners to consider investing in building characteristics that serve to reduce operating expenses and/or increase the building class rating, as both of these building attributes have been shown to be more significant in explaining the variance in office rents than LEED certification.

B. Limitations and directions for future studies

Despite the efforts made to ensure the best possible design for the study, there are limitations that should be acknowledged. First, due to the confidential nature of information related to tenant lease contracts, information related to actual rent per square foot paid and tenant inducements were not included in this study. Instead, average net asking rental rates for each building were used as a proxy. If possible, future studies should look to include information related to actual transacted leases. This would allow for the impact of tenant inducements[12] and actual transacted rent to be used, providing a more accurate depiction of those factors having a significant impact on actual returns to landlords. The use of actual transaction information may also have an effect on LEED certification's inclusion into a model seeking to explain the variance in actual transacted rents.

A second limitation of this study is the inability to generalize study results to other markets. This study was not intended to generalize findings to other real estate markets, but rather to gain insights on the influence of LEED certification within the market studied. Future studies may look to expand the study area beyond the boundaries of Toronto or increase the number of Canadian submarkets included in an effort to determine if LEED's impact on rents changes based on market/submarket characteristics.

A third limitation of this study is that, due to the relative infancy of the LEED movement in Canada, it was only able to provide a snapshot of the impact (or lack thereof) that LEED certification has on net asking rent. As this movement matures, longitudinal studies related to the change in costs and benefits over time and over varying economic conditions would prove valuable. Such studies would not only provide a historical trend analysis, but may also provide key stakeholders some foresight as to issues and opportunities that may become factors in the near and distant future.

The infancy of the LEED movement in Canada was also cause for the limited number of LEED certified buildings being available for inclusion in this study, resulting in a sample size that would have only allowed for the inclusion of those variables thought to have a medium to large effect size on net asking rents. As more LEED buildings enter the market, future studies will be able to increase sample size to a level that would allow for the detection of a smaller effect size on net asking rent and other measures of value.

Finally, it is important to note that this study does not provide an assessment of the incentives provided by various regions in an effort to encourage responsible property development. As the goal of this study was to assess the impact of LEED certification on net asking rents, future studies may look to undertake a complete cost/benefit analysis that takes into account incentives to LEED

[12] Tenant inducements may include such things as free rent periods, modification of the space according to tenant specifications, or any other form of incentive a landlord may offer a prospective tenant in efforts to let space.

certification not resulting from market value impacts. Studies of this nature would also allow for the identification of regions considered most encouraging of responsible property development, and perhaps even more importantly, would provide other regions with information on what initiatives have been successfully adopted elsewhere that may be applied to their own.

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