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Does Size Matter? Findings on the Green Building Cost Premium in South Africa for 2009 - 2018

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ABSTRACT

Since the Green Building Council South Africa (GBCSA) was established in 2007, the frequent perception that green building has a significant and unaffordable cost premium challenged the progress of green building. Various studies confirmed that this opinion exists worldwide. In response, the GBCSA, the Association of South African Quantity Surveyors (ASAQS) and the University of Pretoria (UP) started a joint study in 2014 to provide accurate data on the actual cost of South African green buildings. The study findings are based on the cost data of all new office buildings awarded a Green Star certification by the GBCSA using the Green Star Office v1/v1.1 rating tool. A total of 170 new office buildings fit this profile. The study findings were published in industry booklets in 2016, 2019 and 2022. In addition to reporting on the cost premium of green building, the aim of the study was also to consider prominent building features driving green building costs to develop a deeper understanding of the nature of green building cost. These building features include the certification level, the size, the base building cost, the certification date, the tenant mix and the vertical façade ratio of the buildings. The study found an average green building cost premium (GBCP) of only 3,96% in 2019, reducing to 3,63% in 2022. The study also found that the construction area of the study population's buildings had a consistent negative correlation with their green building cost premium. This study will describe a more detailed relationship between building size and green building cost premium. The information will add value to the green building industry and all the relevant stakeholders, such as property owners and developers, the GBCSA, the ASAQS and the quantity surveying profession. The findings can also be compared internationally to serve the wider green building industry.

Keywords: Cost drivers, Cost premium, Green building, Quantity surveyors, South Africa

INTRODUCTION

Global warming and climate change are serious environmental challenges of our time (UNEP, 2007; Birne et al., 2009; Onarheim and Arthun, 2017). Current species extinction rates are 1000 - 10,000 times the natural extinction rate, driven by human lifestyle without regard for non-human species (Kopnina, 2014; IUCN, 2014). Addressing global warming towards more sustainable goals requires global action (Kumar and Geneletti, 2015; Preston et al., 2011). The consequences of years of indiscriminate use of resources are unpredictable and mostly negative (Suzuki and Dressel, 2004).

Hes and Du Plessis (2015) warned that minor adjustments to a fundamentally flawed system of growth and development would not solve our problems. The most severe environmental challenges originate from urban regions (Reith and Orova, 2014), fuelled by the accelerating global urbanization of people, technological development and modern lifestyles (United Nations, 2011; Hedge and Dorsey, 2012).

The built environment contributes significantly to global warming, with 40% of global energy use and 30% of greenhouse gas emissions linked to buildings (Kriss, 2014; Pekka, 2009; GBCSA, 2016; WGBC, 2016; Morgan Stanley, 2016; Kruse, 2004). Similar research findings are true of South Africa (CIDB, 2009; Milne, 2012).

The built environment responded by founding the WGBC in 1999. The nine founding members have now expanded to eighty member countries. The WGBC support the global green building initiative, coordinates green rating certification systems, and provides industry benchmarking standards (WGBC, 2020). The GBCSA was established in 2007, and the Green Star SA rating tools were launched in 2008 (GBCSA 2014; GBCSA, 2019).

Many challenges confront the green building industry, the highest barrier being the perceived capital premium of green developments (Kats, 2003; Lockwood, 2008; Kats, 2010; Milne, 2012, WGBC, 2013; Coetzee and Brent, 2015; Morgan Stanley, 2016).

THE MERIT FOR THE STUDY

By 2014, no reliable cost data existed on the cost premium of South African green buildings. The GBCSA, the ASAQS and the UP started a joint study describing South African green building cost. The study evaluated the cost of Green Star-rated office buildings certified until the end of December 2018 (Hoffman, 2023).

The study found a GBCP of 3,96% with a spread of 1,14 % - 14,24%. Figure 1 details a prominent study finding of the significant negative correlation between construction size and GBCP (r = −0,906)(Green Building

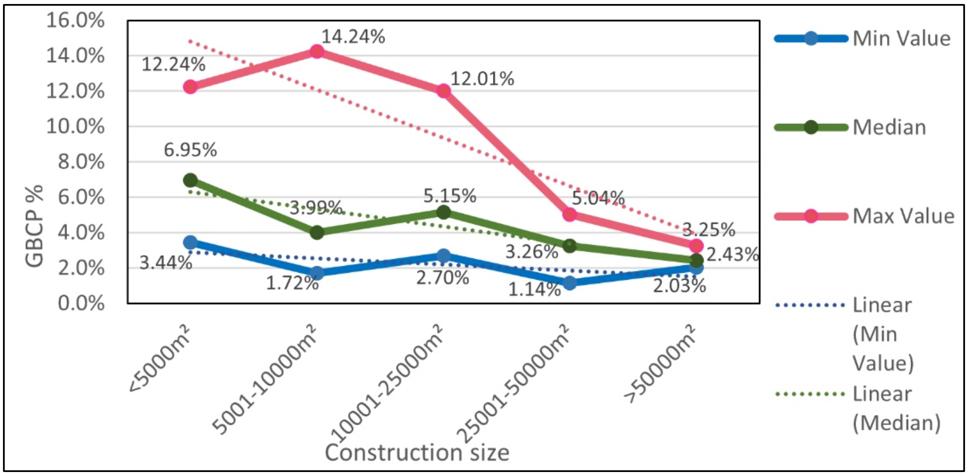

Figure 1: Construction size of buildings vs the GBCP (Source: Green building, 2019).

in South Africa, 2019). This follow-up study further explores the relationship between construction size and GBCP. A more detailed understanding of green building cost will lessen the uncertainty and risk for decision-makers regarding green building.

METHODOLOGY

The study findings are based on the cost data of all new office buildings awarded a Green Star certification by the GBCSA using the Green Star Office v1/v1.1 rating tool. A total of 170 new office buildings fit this profile. The quantity surveyor on each building was requested to forward a detailed, Excel-based financial transparency report, enabling the study to collect the cost data required.

The study employed several generic building features linked to green building costs to further understand green building cost premiums. These building features include the Green Star certification level (4, 5 or 6 Star), construction area, tenant mix, the base building cost (R/m^2), the façade : construction area ratio, and the certification date of buildings.

The base building cost of all the buildings escalated to December 2018, varied between R9 028/m^2 and R28 983/m^2. The original study applied five base building cost categories to evaluate the relationship between base building cost and GBCP. This follow-up study is further exploring the relationship between construction size and GBCP. The findings of the relationship between the GBCP and the construction area are used as the basis or point of departure. The findings of every one of the other building features are combined with the basic finding to pursue a deeper understanding of the relationship between the GBCP and the construction size of green office buildings.

The study used the data and statistical analysis tools forming part of the Excel software.

FINDINGS

Construction Size and Green Star Rating

The 4 and 5 Star buildings displayed a similar negative correlation between construction size and GBCP. The negative correlation was much more significant for buildings larger than 25,000m^2. 5 Star buildings smaller than 25,000m2 also had a much higher GBCP than 4 Star buildings of similar size. There were no 4 Star buildings of more than 50,000m^2, while the small number of 6 Star buildings prevented a meaningful analysis across five size categories.

Construction Size and Base Building Cost

The original study's five base building cost categories had to be reduced to two even-sized categories of base building cost to ensure enough case studies in each of the five construction size categories, namely, buildings costing < or > more than R15 000/m^2. Both data sets displayed a relatively weak negative correlation between base building cost and GBCP ($r = -0{,}7023$

and −0,6513 respectively)(see Figure 3). The resulting coefficient of determination for buildings with a base building cost of > R15,000/m^2 was only 0,4242. The data on base building cost confirmed that for buildings smaller than 25,000m^2, the base building cost displayed very little meaningful relationship between construction size and GBCP. For buildings larger than 25,000m^2, the data confirmed the negative correlation between construction size and GBCP.

Construction Size and Façade Ratio

Many research studies agree that a smaller façade area supports an energy-efficient building (Pacheco, Ordónez and Martínez, 2012; Aksoy and Inalli, 2006). The original study, therefore, considered the effect of the façade : construction area ratio of buildings on the GBCP. The study calculated the façade

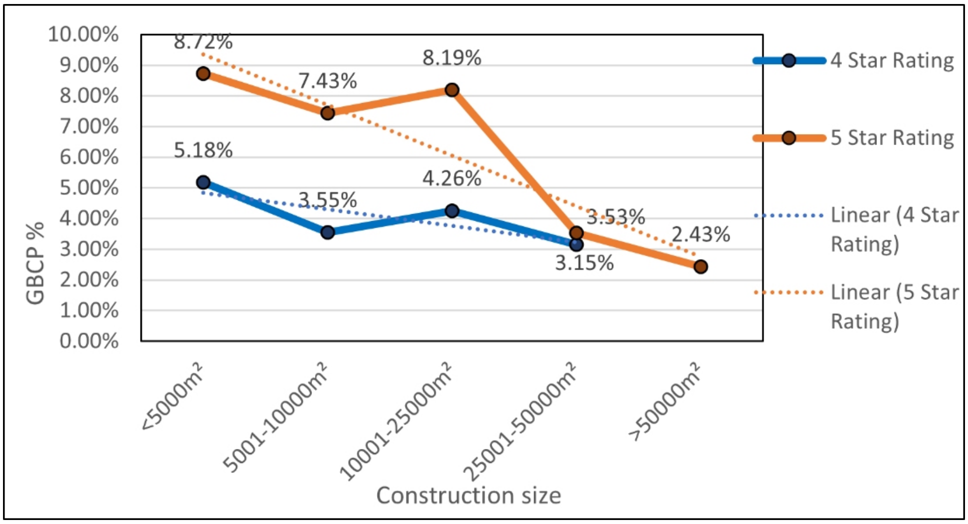

Figure 2: Construction size and certification level vs the GBCP (Source: Authors, 2023).

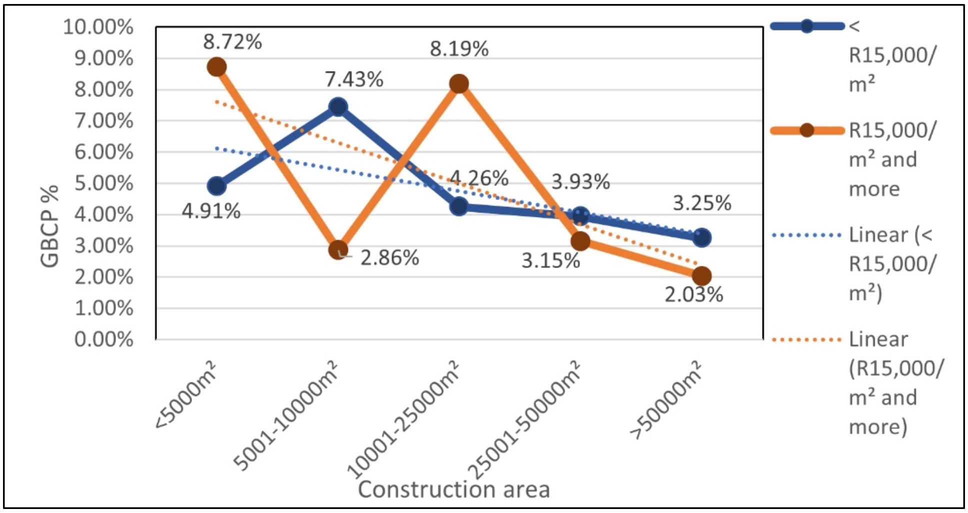

Figure 3: Construction size and base building cost vs the GBCP (Source: Authors, 2023).

: construction area ratio of all buildings with a minimum ratio of 0,19m^2/m^2 and a maximum ratio of 0,84m^2/m^2. The original study's five façade ratio categories had to be reduced to two even-sized categories of façade ratio to ensure enough case studies in each of the five construction size categories, namely buildings with a façade ratio < or > than 0,44m^2/m^2.

Figure 4 confirmed that within the building size categories, buildings with a façade ratio of > 0,44m^2/m^2 confirmed the strong negative correlation between construction size and GBCP ($r = -0{,}7928$ and $r^2 = 0{,}6286$). Buildings with a façade ratio of < 0,44m^2/m^2 displayed a weak negative correlation ($r = -0{,}4974$ and $r^2 = 0{,}2474$). For buildings smaller than 10,000m^2, a façade ratio of > 0,44m^2/m^2 resulted in a higher GBCP than a façade ratio of < 0,44m^2/m^2. However, the opposite was true for buildings larger than 10,000m2, and a façade ratio of > 0,44m^2/m^2 resulted in a lower GBCP.

Construction Size and Certification Date

The buildings were divided into two groups – those certified up to and those certified later than 2014 to evaluate the effect of the certification date on the relationship between building size and GBCP. The original study found a strong negative correlation between the certification date and the GBCP (Green building, 2019). In agreement with that finding, the follow-up study found that both certification date groups confirmed the strong negative correlation between building size and GBCP ($r = -0{,}9106$ and $r^2 = 0{,}8291$ for buildings 2009–2014 vs $r = -0{,}9082$ and $r^2 = 0{,}8278$ for buildings 2015-2018)(see Figure 5). For buildings smaller than 25,000m^2, the buildings certified up to 2014 presented a significantly higher GBCP.

Construction Size and Tenant Mix

The original study made a very distinct finding regarding the relationship between tenant mix and the GBCP of buildings. Most buildings certifiedduring the initial years were single-tenant, typically with a higher

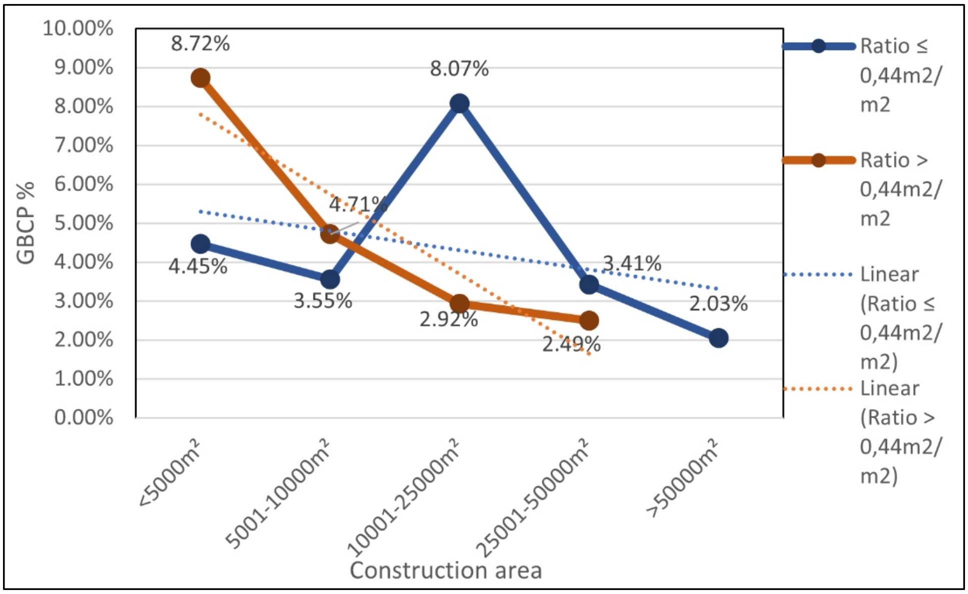

Figure 4: Construction size and Façade ratio vs the GBCP (Source: Authors, 2023).

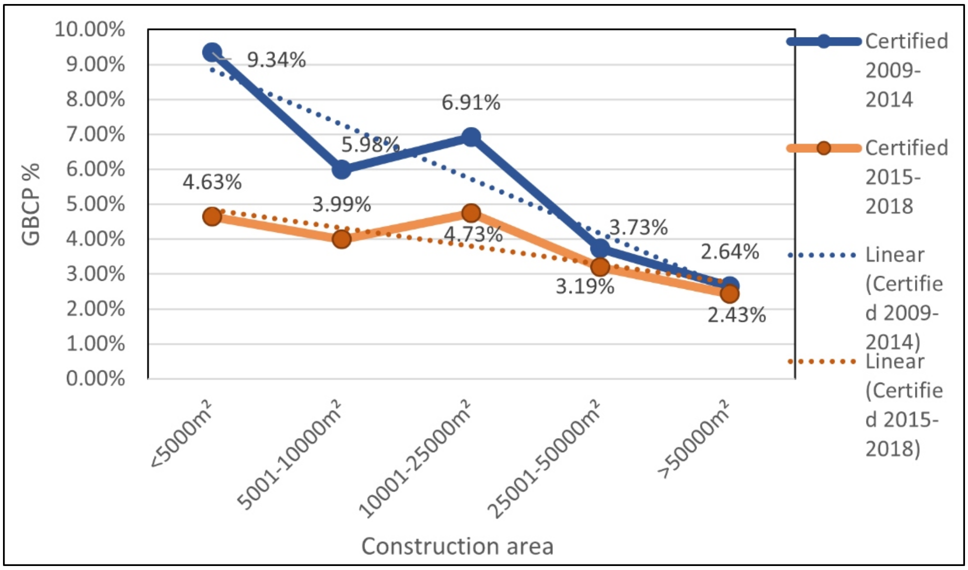

Figure 5: Construction size and certification date vs the GBCP (Source: Authors, 2023).

base building cost and GBCP than the few multi-tenanted green buildings. The average GBCP for single-tenanted buildings certified not later than 2014 was 8,13% compared to 3,55% for multi-tenanted buildings. However, for buildings certified later than 2014, the GBCP of single-tenanted buildings of 3,53% were very similar to the 3,30% of multi-tenanted buildings.

The follow-up study found that single and multi-tenanted buildings confirmed the strong negative correlation between construction size and GBCP ($r = -0{,}8996$ and $r^2 = 0{,}8093$ for single-tenanted buildings vs $r = -0{,}9276$ and $r^2 = 0{,}8604$ for multi-tenanted buildings)(see Figure 6). For

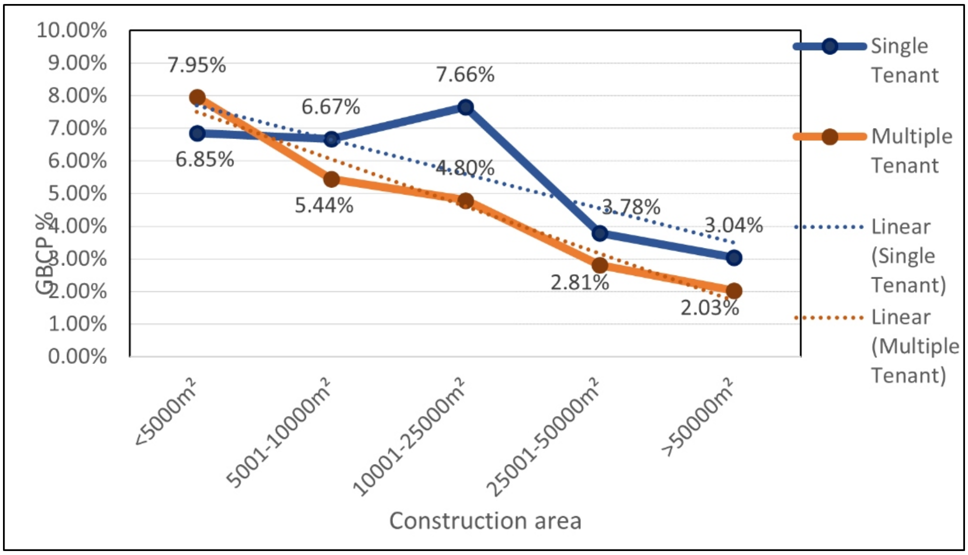

Figure 6: Construction size and tenant mix vs the GBCP (Source: Authors, 2023).

all buildings larger than 5,000m^{2,} single-tenanted buildings presented with a higher GBCP.

CONCLUSION

The study findings explored and expanded on some of the original study's findings. The first finding was that for all buildings smaller than 25,000m^2, 4 Star buildings presented lower GBCP than 5 Star buildings. Both 4 and 5 Star buildings confirmed the negative correlation between building size and GBCP.

The second finding confirmed that for buildings smaller than 25,000m^2, the base building cost had no constant, meaningful relationship with the GBCP. For buildings larger than 25,000m^2, the data on base building cost confirmed the negative correlation between construction size and GBCP. These larger categories of buildings with a base building cost exceeding R15,000/m^2 also presented with lower GBCP than buildings with a base building cost lower than R15,000/m^2.

In the third instance, buildings with a façade ratio of > 0,44m^2/m^2 confirmed the strong negative correlation between construction size and GBCP. Buildings with a façade ratio of > 0,44m^2/m^2 presented a lower GBCP for buildings less than 10,000m^2 and a higher GBCP for buildings larger than 10,000m^2.

Regarding the certification date, the follow-up study found that both certification date groups confirmed the strong negative correlation between building size and GBCP. For buildings smaller than 25,000m^2, the buildings certified up to 2014 presented a significantly higher GBCP than those certified after 2014.

For both single and multi-tenanted buildings, the study confirmed the strong negative correlation between construction size and GBCP. For all buildings larger than 5,000m^{2,} single-tenanted buildings presented with a higher GBCP.

A deeper understanding of the dynamics of green building cost will assist property owners and property consultants to embrace the critically important shift towards a more sustainable industry with greater purpose and resolve.

RECOMMENDATIONS

This study's findings broadly supported the original study's findings on the relationships between GBCP and the building features mentioned in the study. The follow-up study also confirmed that combining the findings on the construction size of buildings with that of the other building features, on some occasions, revealed more insight into the data and the expected GBCP of certified green buildings.

Based on the study findings, a recommendation is to also consider a follow-up study on the original study's conclusion that the data shows signs of the growing maturity of the green building industry.

A number of the findings of this study confirmed the dynamic nature of data on green building costs. The study, therefore, recommends that the study of the relationships of the green building cost of certified buildings be continued. Consideration should also be given to expanding such studies to include existing building performance certifications, retail, industrial and public sector buildings.

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