

# Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



## Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners ([Examencommissie-BK@tudelft.nl](mailto:Examencommissie-BK@tudelft.nl)), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

<b>Personal information</b>	
Name	Rens van Overbeek
Student number	

<b>Studio</b>		
Name / Theme	Management in the Built Environment Real Estate Management – Building Economics	
Main mentor	Farley Ishaak	Management in the Built Environment Real Estate Management Real Estate Economics
Second mentor	Ellen Geurts	Management in the Built Environment Real Estate Management Real Estate Economics
Third mentor	Hilde Remoy	Management in the Built Environment Real Estate Management
Argumentation of choice of the studio	Real Estate Economics, part of the Chair Real Estate Management, examines market dynamics of the four interlinked real estate markets and the behavior of the actors involved. This research focuses on the willingness to pay for environmental certification in the Dutch office market and is heavily intertwined with real estate market dynamics in the macro-economic context. The expertise of the mentors is in Building Economics, which helps to position this research in the wider macro-economic context, and Commercial Property Price Indices (Statistical Analysis), which helps in the methodological justification.	

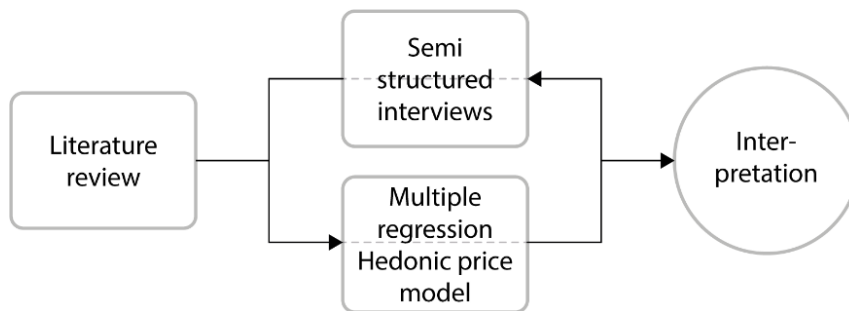
<b>Graduation project</b>	
Title of the graduation project	Sustainable value drivers – A research on the added value of environmental certification in real estate pricing
<b>Goal</b>	
Location:	The Netherlands

<p>The posed problem,</p>	<p>Among practitioners, there is a common perception that green buildings generate added value. However, the added value is neither precisely defined nor researched. The U.S office market has been extensively studied. However, less attention has been paid to European markets, including the Dutch office market. The lacking evidence of the economic feasibility caused investors and developers to be conservative about environmental investments. Practical evidence from the Dutch real estate markets is needed to bring more clarity in the public debate around green buildings and to stimulate the industry towards an environmentally friendly built environment.</p>
<p>research questions and</p>	<p>This problem statement brings us to the following main research question:  <i>How does environmental certification influence market value in the Dutch office market?</i></p> <p>With the following sub questions:</p> <ol style="list-style-type: none"> <li><i>1. What phenomena are driving real estate markets?</i></li> <li><i>2. What building characteristics are determinants for real estate market value?</i></li> <li><i>3. What are sustainable value drivers in the real estate market?</i></li> <li><i>4. How has BREEAM-NL certification developed since its introduction?</i></li> <li><i>5. How influences BREEAM-NL certification market rent prices and occupancy rates in the Dutch office market?</i></li> </ol>
<p>Design assignment</p>	<p>Mixed-method research with multiple regression analysis and explorative interviews.</p>

In order to examine the relationship between environmental certification and market value, an explanatory mixed method is used (see figure below).

The quantitative research follows the current literature and uses the hedonic price model to test the hypotheses on the relationship between environmental certification and market rents in the Dutch office sector. The hedonic price model is a commonly used technique to analyse the marginal impact of rent determinants in real estate research.

In addition to the quantitative statistical approach, explorative semi-structured interviews are used. This qualitative research method aims to test the applicability of the international literature review to the Dutch context.



## Process

### Method description

This mixed-method research takes a qualitative and quantitative methods approach and uses explorative data triangulation to test the international literature to the Dutch context.

First, an international literature review will analyse the fundamentals of commercial real estate markets and determine important office rent determinants. This helps to position real estate research in the entire scientific context. More recent publications can complement historical scientific publications by providing additional examples and insights by fundamental real estate theories and models.

The main research method to examines the effect of environmental certification on market value in the Dutch office market is hedonic price modelling. This is a commonly used method in the real estate research to determine the value of important rent determinants.

In addition to this applied statistical analysis, explorative interviews are used to test the international literature to the Dutch context and to validate the variables used in the statistical analysis. The interviews can help to discover relevant trends and beliefs which shape the Dutch context.

## Literature and general practical preference

### Literature

*Commercial real estate:* The literature review on commercial real estate will mainly use published books around commercial real estate investment / analysis (McDonald & McMillen, 2011; Geltner et al., 2007; Pirounakis, 2012). The framework of DiPasquale & Wheaton (1992) is used to explain the fundamentals of the commercial real estate market.

The literature review will be complemented by a Dutch book (Van Gool et al., 2013) on commercial real estate investment which is more applicable for the Dutch context.

### *Hedonic price model:*

The theory of Rosen (1974) on product differentiation is fundamental for the emergence of the hedonic price model. In addition, multiple sources (Herath & Maier, 2010; Chin & Chau, 2003; Freeman, 1979; Rottke & Mutle, 2015; Pirounakis, 2012) are used to justify the choice for the hedonic price model and present the limitations inherent to this theory.

### *Environmental certification*

The literature review will mainly use primary sources of BRE (owner of BREEAM), WELL and LEED to analyse and compare the available building certificates. In addition, recently published papers on building certificates complement the primary sources in the history of environmental certification and the comparison of the available certificates.

### Data

Lease transaction data of CBRE BV will be used to determine the effect of environmental certification on market value. This dataset includes lease transactions from 500 m<sup>2</sup> with information on rent level, lease size and -length and a complementary dataset includes hedonic characteristics such as locational- and building attributes.

Data provided by the Dutch Green Building Council (DGBC) includes data on every BREEAM-NL certificate including building ID, certification date and relative scores.

## Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

My project topic tries to bring clarity in the public debate around economic feasibility of environmental certification in the Dutch office market. The market actor's willingness to pay for environmentally friendly buildings has influence on all three markets of real estate: space-, asset- and construction market, a major topic within the chair of Real Estate Economics. Also, the track Management in the Built Environment aims to create a sustainable, future-proof built environment. Practical evidence from the Dutch office market can help to boost this transition.

## 2. What is the relevance of your graduation work in the larger social, professional, and scientific framework?

### Societal relevance:

National Governments are closely cooperating with the European Committee with the aim to reduce the greenhouse emissions and carbon footprint caused by the built environment. As a result, laws and regulations regarding the sustainability performance of buildings have been majorly reinforced over the last decades.

BREEAM-certified buildings are generally more environmentally friendly, protect and preserve natural resources and increases the well-being of the users. As BREEAM-NL criteria are exceeding the statutory minimums, the decision of building owners to assess their assets on BREEAM-NL is always voluntarily.

BREEAM certifications aim to increase the market value of its properties, and similarly to the revised EPBD III, help investors to make proper investment decisions. However, to reinforce these claims, investors first need to have evidence from the market, proving the increased returns and market value.

### Scientific relevance:

The U.S office market has been extensively studied. However, less attention has been paid to European markets, including the Dutch commercial real estate market.

Additionally, the reported studies to date covered a limited range of real estate transactions, mainly focused on transactions till 2015. It is only then that BREEAM-NL had its major breakthrough as environmental certification in the Dutch markets. It is not clear whether the suggested price premiums can be fully accounted to environmental certifications. Research has tended to focus on only a few control variables, mostly limited to size and location. Hence, additional studies on the effects of environmental certification are needed.

### References:

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3. Geltner, D.M., Miller, N.G., Clayton, J. & Eichholtz, P. (2007). *Commercial real estate: analysis & investments*.
4. Freeman, M. (1979). Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues. *The Scandinavian Journal of Economics*, 81(2), 154-173.
5. Herath, S. K. & Maier, G. (2010). *The hedonic price method in real estate and housing market research. A review of the literature..Institute for Regional Development and Environment (pp. 1-21). Vienna, Austria: University of Economics and Business.*
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9. Rottke, N.B. & Mutl, J. (2015). *Development of Hedonic Office Rent Indices. Examples for German Metropolitan Areas*. Springer Gabler.
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