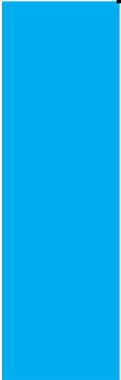


Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examcommissie-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:

Personal information	
Name	Maximilian Nepomuk Sepp
Student number	6083587

Studio		
Name / Theme	Value and valuation in the Management of the Built Environment	
Main mentor	Dr. ir. Michael U.J. Peeters	Assistant Professor ESG - Sustainable Finance, Smart Building & Valuation – MBE Department
Second mentor	Prof. dr. ir. Vincent H. Gruis	Professor of Housing Management – MBE Department
Argumentation of choice of the studio	High interest in research on valuation of real estate/financial models	

Graduation project	
Title of the graduation project	Real Option Valuation of Circular Real Estate
Goal	
Location:	Netherlands
The posed problem,	The construction and real estate industry contributes approximately 40% of global greenhouse gas emissions, positioning it as a key sector for the transition to a circular economy. A major hurdle in this shift is the lack of a compelling business case, compounded by high upfront costs which deters market parties from adapting circular practices. This thesis investigates the potential of real options to address these challenges by enhancing financial incentives for circular business models. Real options, which grant the right but not the obligation to act on non-financial assets, could enable innovative buy-back schemes for circular building components such as façades, allowing option premiums to fund initial investments.
research questions and	To what extent can the selling of real options enhance the business case for circular economy practices in the real estate industry?

	<p>Sub-questions:</p> <ul style="list-style-type: none"> • To what extent can options on circular building components incentivise market parties to adapt circular practices in the construction and real estate industry? • To what extent can real option valuation be utilised to value circular buildings and building-parts? • To what extent are market participants willing to BUY real options of circular buildings and building-parts? • To what extent are market participants willing to SELL real options of circular buildings and building-parts?
design assignment in which these result.	No design.

Process

Method description

This thesis adopts a pragmatic paradigm to address its multifaceted research question, emphasizing practical, context-driven inquiry and dynamic problem-solving. Pragmatism's flexibility supports the use of a convergent parallel mixed-method approach (triangulation), integrating both quantitative and qualitative research elements to explore the financial applicability of real option valuation methods on circular real estate and market parties' willingness to buy or sell real options on circular building components.

The quantitative research part involves applying three real option valuation methods of varying complexity to case study data from the "Façade as a Service 2.0" project done by the TU Delft in collaboration with CISKIN/Alkondor. This project features a detachable aluminum façade with comprehensive data on material type, quantity and value enabling robust calculative testing. Deliverables will include a comprehensive analysis of the case study data comparing calculated real option values. The findings will be supplemented by detailed data sets including input parameters for each method and sensitivity analysis charts.

The qualitative section includes semi-structured interviews and a workshop to explore stakeholder perspectives and potential barriers to adopting real options. Additionally, a graduation internship at Rabobank provides access to market data and connections to industry professionals.

Introducing a novel concept open to further research in different directions, this proposal targets mainly academics focused on circular real estate and real estate finance, however practitioners might likewise explore methods showcased within this thesis as innovative valuation techniques identifying added value of flexibility in circular real estate.

For further, more detailed information please refer to the P2 report.

Literature and general practical references

The literature review for this thesis is already completed (see P2 report), subject to a few minor future additions. This is a short summary of what theory is analysed within this chapter:

Starting with a section on "Barriers and Enablers of Circular Real Estate" the literature review gives insights on the current state of research on what factors hinder market parties to adapt circular real estate practices. This is expanded through an analysis of potential enablers of this transition. Both sections focus especially on the category of financial enablers and barriers.

The second main body of theory analysed within the literature review provides an overview on real option theory starting with the origin of real option analysis methods and its development through time. This is supplemented by a chapter on calculation methods and general analytical approaches to the valuation of real options followed by a short excursus on real option game theory. Lastly, the literature review ends with insights into research done on the connection between real option analysis and real estate projects.

For further, more detailed information including references of literature used please refer to the P2 report.

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)?

The graduation topic is closely aligned with the theme of the graduation group as it investigates valuation of (circular) real estate through the lens of real options, respectively the valuation of real options, potentially revealing a "hidden value" in circular real estate practices. The approach is a good example how financial models such as real options can potentially change the way market parties and professionals think about architecture and how buildings, circular or not, might be designed in the future. A new way of capturing the value of building material could influence material and technical choices in building design significantly. Being based within the architecture faculty is therefore very valuable for further investigation of this topic, maybe even by non MBE students or researchers.

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

The construction and real estate industry is, as previously mentioned, a key factor in the transition from a linear to a circular economy. Potentially enhancing this transition by enabling a business case for circular real estate practices would make the work of this thesis relevant for professionals trying to establish such a circular business model, including for example the case study data provider CISKIN. The main aim is that the option premium also covers the additional cost of building circular therefore leading to a shared profit for both owner and supplier side.

On a larger social scale does the thesis topic have the prospect to enhance circular practices leading to a general reduction of raw material dependency and more. Concerning the academic point of view, it has been identified that there is no research on this topic so far meaning that this thesis introduces a novel concept to the scientific community also opening a variety of possibilities for further research.