How can Circular Strategies be Implemented in Real Estate Valuation Practices

AN EXPLORATORY RESEARCH

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TU DELFT
COPPER8

Master Thesis

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PREFACE

As an architecture student who shifted to the studies of Construction Management in the Civil Engineering department, the mind always connected towards 'building-specific, relatable-scale projects' to get a clearer perspective of concepts. Hence, when this research topic of exploring the real estate industry came along, it felt like the right decision to pursue my graduation in this domain. It made me explore the now comfortable, but then unknown, but interesting field of the Circular Economy. My passion for sustainable design, and making the world a better place, was given a position to explore in the form of this graduation research. The last eight months have been a roller-coaster of a journey, with lessons learnt beyond just educational limits.

My Master thesis conducted as a part of my studies in Construction Management and Engineering at Technical University Delft titled, *"How can circular strategies be implemented in current Real Estate valuation practices?"* was done in collaboration with Copper8. Copper8 is a well renowned consultancy and one of the front runners for recognizing the need to transition to a Circular Economy. Their zeal to help every industry that came by making this transition, has been one of my biggest motivations. After months of confusion, debates, and dejections about how difficult (and sometimes impossible) this transition seems to be, I believe I am finally at this position where I can confidently express the need for a Circular Economy. The Real Estate industry has so much potential for change, and various aspects of the transition in this industry are yet to be explored. This thesis aims to bridge the gap between the circular design principles implemented in construction, to finally seeing a reflection of sustainable practices in property prices. I would like to take this opportunity to express my gratitude to everyone who has been a part of my journey.

I would first like to convey my deepest gratitude to my supervisors at the TU Delft. As expressed by my Chairperson, Professor.Dr. Paul Chan in our first meeting with the committee, I have the 'A' team to support me in my endeavors. I truly did. Dr.ir. Catherine De Wolf, Juan F. Azcárate-Aguerre, and Dr. Daan Schraven (My first, second and third supervisors) have been with me throughout the journey. Each of them has their own unique expertise that helped me elevate my research at each level. While Catherine has been extremely precise with her reviews and suggestions to bring high quality into my work, Juan helped me break things down, slow down and assess better what I have. He made me believe that this would work out, on days when my faith was low. Daan compelled me to break out of a singular direction of thought and made sure I approached my research in an organized manner, with clarity of my end goal. Professor Paul Chan would provide the best articulations of all my feedback, as well as make me explore the crux of this research in ways only an experienced professional as him would be able to put forth. I am extremely indebted to all of them.

Secondly, this thesis would not have progressed the way it did without the constant support of Noor Huitema and Floris van Haagen, my supervisors from Copper8. Noor helped me instill confidence in myself by connecting me with the best stakeholders in the industry to conduct my interviews. She has been extremely understanding and her experience in the industry has been precious to me. Floris has been my biggest support along the entire journey, with me discussing with him my successes and failures every week. His constant encouragements, attitude of going out of his way to help me stay on track, as well as weekly reminders to not work 'all weekend' has made my journey at Copper8 worthwhile. The rest of the team have been constant support through each online weekly meetings, which gave me a feeling of working in a close-knit office.

The journey over the last eight months has been an emotional upheaval, with experiences that tested my strength and persistence at every stage. Enduring it without my support system of friends and family, here in the Netherlands as well as back in India would be very difficult. I am grateful to all of them, for helping me push through.

The largest piece of gratitude goes to my father and sister, without whom I would not be what I am. The level of confidence and strength they instill in me, makes me the best version of myself. They taught me to look at everything positively, to stay hopeful, and to constantly stand up and come back stronger during the chaos.

I wish you an enjoyable read!

Ritika Utmani

EXECUTIVE SUMMARY

Introduction

The construction sector, as one of the world's greatest waste generators, is responsible for a cascade of events such as global warming, climate change, and natural resource depletion. Materials are being depleted to a considerable amount over the world, and the waste generated in the operations is not being properly managed. The general lack of recycling, reuse, and waste exploitation is a direct result of low-cost resources and high-cost labor. The lack of regulatory controls, as well as the use of "lock-in inertia," is what gave rise to what is now known as the linear economy (Sariatli, F.,2017). A linear model of resource consumption follows the 'take-make-dispose' pattern (Ellen MacArthur Foundation, 2013a; Andrews, 2015). This indicates that the supply chain begins with establishments extracting raw materials to produce items and concludes with a client who purchases and disposes of the product after use. This means that raw resources are continuously extracted from nature, and the rate at which they can refill is insufficient to meet demand. This system suffers significant losses across the value chain (Ellen MacArthur Foundation, 2013).

On the contrary, the circular economy concept proposes a circular model of 'reuse-refurbish-recycle' that focuses on reducing waste and optimizing resource value retention. The strategy is ideal to adopt in a high-growth, high-waste sector like the built environment. When it comes to the built environment, circularity encompasses more than just the materials that make up a building. It also seeks to combine an economic framework that is more responsive to the global environment both during and after construction, as well as a social focus.

Because of the issues that the construction industry faces, it is well-positioned to lead the worldwide movement toward circularity and sustainability. Real estate investors and building clients play a significant role in the transition to a circular built environment because they can direct the course and design of each project's growth plans, ownership arrangements, and organizational models at all phases of its life cycle.

The reason this research was taken up is because a significant gap is seen within valuation practices. The current valuation methods, although efficient, collect data and provide property valuations based on previous studies. For example, when using a comparative method of property valuation, we compare one asset with a neighboring one, that has similar features. This process incorporates the older values already provided to this old building, without accounting for innovations such as reusability or adaptability of the components. In some cases, certain older properties are valued based on traditional depreciation, wherein eventually, the building value will be depreciated down to a lower rate, which may consequently disinterest any potential buyers, and make it a non-profitable investment.

How different would the sector be if we incorporated the value of circular interventions to the original value determined, rather than looking back at older valuation standards? Will there be a significant difference, and, more importantly, would it impact the way real estate investors viewed circularity? The fact that the property's value at the end of its life is projected to be higher than predicted (in normal conditions) is already reason enough to think about making the switch.

The aim here is then to realize how the real estate industry can incorporate circularity into its existing framework, specifically in real estate valuation. To do so, the first step would be to learn about present valuation methodologies and how accommodating they are of measures that encourage circularity. Simultaneously, it is critical to understand why the Real Estate industry has not made significant headway in shifting from a linear to a circular model. After that, the next step would be to build a link between circular principles and valuation

criteria, and then test whether circularity can be established in RE Valuation practices (through literature, interviews, and surveys). The analysis comes to the following question based on all these variables:

How can circular strategies be implemented in current Real Estate valuation practices?

Methodology

Because understanding what already exists is so important in this project, conducting interviews and questionnaires is the best approach to learn what real estate investors and valuators have to say about implementing circularity. In this manner, it's clear where each organization is in its development cycle, as well as how they perceive circularity. As a result of these interactions, it will be possible to assess why some approaches have not yet been accepted or do not produce the intended results. After these have been evaluated, solutions can be suggested.

The Delphi method used, is a data collection approach for decision-making among isolated, anonymous respondents. By triangulating subjective group decisions, analytical tools, and the researcher's experience, it tries to lead group views toward a final decision and to answer questions (Cantrill, Sibbaldand Buetow, 1996). This is a multi-step technique in which each stage builds on the one before it. All parties submit extensive statements as part of a process that aims to stimulate responders to think about the complexities of the issue and develop tangible, high-quality proposals.

Results

To begin, the primary hypothesis of this study is that there is a link between circularity and valuation and that this link can be incorporated within present valuation procedures. The thesis research explains how the connections can be made, as well as specific actual instances for each. The number of possible scenarios is endless, as there are other options (in addition to the ones given) where circularity can be incorporated. As a result, this study is not limited to the instances given. Having said that, while there is potential for a link between the two, it is not obvious at this time. This is supported by an assessment of numerous valuation reports that highlight but do not account for sustainability considerations. Conversations with interviewees reinforced this. While circularity and sustainability do not affect a property's final worth, there is a visible difference in terms of cost savings from employing harvested materials, as well as in the operations and maintenance of sustainable structures in terms of energy savings. The move to value on paper is still in progress.

Throughout the research, the additional scope of including circular strategies in valuation parameters were seeming more feasible. What started as a black and white slate of two very interesting themes, the amalgamation of the two themes enabled the researcher to explore a grey area with seemingly endless possibilities. Each session with interviewees as well as supervisors displayed more options of seeing the possibility of the two domains merging. The exploratory research led to forming interesting connections between the two. For the findings related to the link of each parameter of valuation to circular design principles, while most validations agreed with the proposed linkages, there were various interesting comments and suggestions for the betterment of each. These included core ideas and recommendations on how to relate these in legislative terms, developing the notion of many tax-related reforms, and reminding the researcher that circularity is a part of sustainability, which should be the larger picture in play. The aspects of circularity that are already visible in some projects do contain a value, although it is not physically visible yet. The current value is more for brand marketing and being forerunners in the industry. Stakeholders believe that stronger regulations will come into place soon, and they would like to be ready for it.

Finally, because this report is designed for a valuator, the significance for them must be addressed. Although no specific expertise is required to implement the proposed elements, it would be easier to do so in practice if valuators were more susceptible to and receptive to them. In terms of more in-depth talks in the subjective realm, the pattern of appraisal consideration shifts slightly. Deliberations regarding how each parameter might be influenced, either among themselves or with clients, can aid in perceiving the client's idea of what a "value"

includes, or even their opinion of what value is. There have been a few occasions where investors paid more for a circular building than the recorded worth because they believed it had a lot of potentials and would be profitable. This higher worth was not reflected in any financial institutions, but it will undoubtedly influence how the market perceives the value to be.

As a part of the 'final product', a practical manual, a matrix summarizing the linkage, and a short check list for valuators has been created. This can be found in Appendix E of the report. A gist of the matrix is visible below. It conveys how every circular principle discussed has an impact on Real Estate valuation parameters. The 'manual' that this table is a part of, is a set of 'practical guidelines' for Real Estate Valuators. Each page contains an illustration of a Principle of the Circular Economy, along with a practical example of how it can be implemented.

The main idea is to 'plant a seed' of Circular thought process within the Property Valuation realm, by introducing this manual that is formed and shaped based on the research.

	Calculation/ Financial Parameters					
		Interest Rate	Costs	Income	Vacancy Rate	Time Frame
Circular Principles	*Maximize the amount of sustainable bio-based materials*	Green loans (lower interest rates) allotted by banks	Higher investment costs, lower operational costs	Higher savings, thus larger profit, thus higher income		Longer duration of time needed to earn back investments
	Maximize the potential for high-quality reuse			Satisfaction of clients leads to lower vacancy rate , leading to more consistent income	Satisfaction of clients leads to lower vacancy rate, leading to higher valuation	
	Design with minimum amount of materials		Lower costs due to lesser materials to be purchased			
	Minimize the amount of new (virgin) materials	High interest rates lead to lesser amount of components.	Helps investor mitigate risks related to increasing costs of traditional materials (due to scarcity)			
	Design for maximum functional lifetime		Higher investment, but lower costs due to reduced need for relocation, renovation and repairs	It is possible that higher rents can be asked as the building is capable of completely adjusting to the specific demands of tenants	Ease of adaptability to client requirement leads to lower vacancy rate, leading to higher valuation	Longer duration of time needed to earn back investments
	Design for optimum management and maintenance		Higher investment, but lower costs due to reduced need for relocation, renovation and repairs	Adaptability to client requirements implies lower vacancy rate , leading to more consistent income	Ease of adaptability to client requirement leads to lower vacancy rate, leading to higher valuation	
	Design for multiple lifecycles		Higher investment, but lower costs due to reduced need for relocation, renovation and repairs	Design and usage for longer duration ensures steady income for a long period of time	Ease of adaptability to client requirement leads to lower vacancy rate, leading to higher valuation	
	Maximize the amount of reused materials	High interest rates lead to lesser amount of components.	Lower costs due to lower materials to be purchased			
To what extent is it agreed upon?		3,90	4,19	4,05	3,86	4,10

Limitations and Recommendations

It should be noted that, as a relatively new concept, the circular economy has a variety of definitions and interpretations. This can make it ambiguous for the user and lead to uncertainty about what the true principles of the circular economy are. The definition of the circular economy, as well as the principles that will be studied, has been elaborated in the theoretical background for this research. They encompass the practical domain of how Circular principles are used in real projects.

This study investigates how valuators can evaluate circular design techniques given their present set of already existing parameters. Because the interpretation of valuators is so important, the recommendations investigated may not be carried out in the same way as the researcher intended. As this is an exploratory study, the linkages offered are merely suggestions that the valuator can follow or use as a starting point for additional research in the field of circular values. The examples and scenarios provided are not intended to be followed exactly as written, but rather to help valuators, developers, and investors familiarize themselves with the Circular economy and see the potential for a change in value.

Concerning further recommendations, it might be worthwhile to investigate creating a refined framework of all the strategies elaborated on, and then conduct action-based research to back up the solutions presented here. This study was an exploration, and while the suggested solutions have been validated by experts, putting them into practice requires additional layers before they are concretized. As a result, valuators can begin by looking at case studies of circular buildings to see how circular principles will affect their value reports.

A strong recommendation would be to do a thorough investigation into the government's circularity policies and their consequences for value and then make recommendations to them. The study uncovered several intriguing proposals for the government to implement as sustainability rules. It would stimulate faster change dynamics if those were communicated to municipal bodies. Strict government regulations governing stakeholder recommendations in all sectors can aid in the adoption of the circular economy.

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1. Introduction

The current prevalent economic design has its origins in the traditionally unequal distribution of resources by geographical area, according to the Ellen MacArthur Foundation (2013). Since developed regions could source consumers as well as materials quite easily, they became the hub for inexpensive materials as compared to the cost of human labor. Hence, business models have been adapted accordingly, wherein the producers were extensively dependent on the use of materials but economized on human labor (Sariatli, F.,2017). The widespread lack of recycling, reusing, and exploitation of waste is the direct byproduct of inexpensive materials and expensive labor. The additional lack of regulatory measures and the usage of a "lock-in inertia" is what led to what is now called the linear economy (Sariatli, F.,2017). A linear model of consumption of resources follows a 'take-make-dispose' pattern (Ellen MacArthur Foundation, 2013a; Andrews, 2015). This means that the supply chain starts with companies extracting raw materials to manufacture products and ends with a customer who buys the product and disposes it after its usage. Less importance is given to what happens before and after these stages. This implies that there is a continuous extraction of raw materials from nature, while the pace at which it can replenish is not sufficient to sustain demand. This is a system that is mainly based on usage rather than focusing on the restorative use of natural resources encounters substantial losses along the value chain (Ellen MacArthur Foundation, 2013).

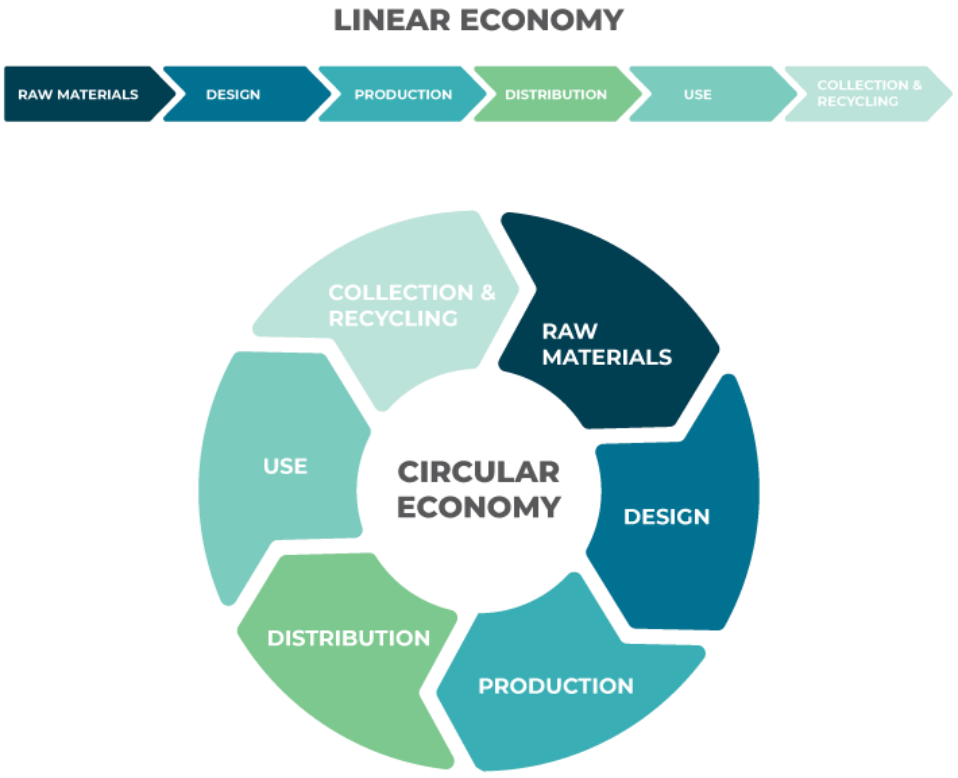


Figure 1: A comparison between linear and circular economy (CarpetCycle)

This need for materials and level of consumption is further aggravated by the increasing wealth levels and population across the world. The worldwide population has been forecasted to increase towards 8.5 billion by 2030 and 9.3 billion by 2050 (United Nations, 2015). This, among other implications, has led to a growing demand for consumer goods, raw materials, and eventually a larger production of waste.

When focused primarily on the construction industry, it is seen that almost a quarter of the output produced by this industry consisted of waste. This excludes the approximately 11 billion kg produced by the demolition of old buildings (Berkel et al.,2019). The construction sector's waste output was higher than in any other industry in 2016, which means that half of the overall waste production was attributed to this

sector. The Netherlands alone produced more waste per inhabitant than the EU's average (Berkel et al.,2019). The World Green Building Council reports that 39 percent of global carbon emissions are accounted for by the building and construction industry. The built environment is responsible for the bulk of global greenhouse gases and the production of raw materials. Environment performance in cities cannot be increased simply by replacing old buildings with new ones, since both the phases of building and operation cause substantial use of resources and energy. This is already enough of a reason to dwell on the importance of introducing a circular approach within this industry, where the focus is also given to what happens at the end of the economic lifecycle of a product, how they can be reused/ recycled, rather than being disposed of as waste.

1.1 Definition of Circular Economy

Circularity is an economic system that does not allow for the wastage of any materials. Products are engineered and constructed such that they are part of a value network where continuous (re-) exploitation of resources is ensured by reuse and refurbishment at the product, component, and material level. This is the definition of Circular Economy, as per the World Economic Forum, which is something that must be strived for, in all industries.

The circular economy offers a solution in terms of a circular model of 'reuse-refurbish-recycle' that focuses on reducing waste and maximizing resource value retention. Within a high-growth and high-waste market, such as the built environment, the concept is ideal to implement. When we focus on the built environment, circularity is more than just about the materials that constitute a building. It also tries to incorporate an economic structure where we are more sensitive to the global environment during and after construction, as well as having a focus on a social base.

Therefore, embracing circular economy approaches within the built environment provides a significant opportunity for developers and building clients to reduce lost value sources and thereby increase the financial return from built environment assets, while also taking a significant path to achieve carbon production targets (Acharya, Boyd and Finch, 2020).

1.2 Problem Analysis

The challenges faced by the construction and built environment suggests that the industry is ideally positioned to take a lead in the global campaign towards circularity and sustainability. The ethical and environmental reason to do so has a strong stance (Acharya, Boyd, and Finch, 2020). Real estate investors and building clients are important members in helping the drive towards the transition to a circular built environment because they have an opportunity at all stages of a project life cycle to set the course and design of their growth plans, ownership structures, and organizational models for each project. While the market for sustainable buildings has rapidly acquired momentum primarily in the design and construction phases of a project, not much has been done yet by the private sector to translate this demand in the development and investment phase (Myers, G., & Reed, 2007).

Most organizations are designed and deeply rooted within the linear approach for growth. Therefore, to venture into circularity, new business cases and revenue models need to be developed, which are free from linear thinking and can give rise to circular principles. For a stakeholder to be driven to accept these additions and reforms, he needs to have substantial reason to do so. The driving factors that would encourage them to adopt circular principles in the real estate sector are yet to be established. While current practices show that initial investment to incorporate circular practices might be more expensive, stakeholders will not be convinced of it if they do not know the benefits of a higher residual value of a property. To focus on one stakeholder as an example, a valuer is an important member of the real estate industry. If there is a need to incorporate sustainable aspects within a property valuation, he must know how to do so. Hence this report focuses on recommendations for a valuator, based on the parameters of valuation.

Additionally, it is important to grasp that to reuse a product or a service, first, a market for that product must be created. To create this market, the value of the usable materials must be known. This is where there is a gap between traditional real estate valuation practices versus the ideal scenario where we can consider circularity. The current valuation methods, although efficient, collect data and provide property valuations based on previous studies. For example, when using a comparative method of property valuation, we compare one asset with a neighboring one, that has similar features. This process incorporates the older values already provided to this old building, without accounting for innovations such as reusability or adaptability of the components. In some cases, certain older properties are valued based on traditional depreciation, wherein eventually, the building value will be depreciated down to a lower rate, which may consequently disinterest any potential buyers, and make it a non-profitable investment.

On the other hand, if the concepts of circularity were considered, where the primary focus is to close the loop and harvest materials, rather than to demolish the building, deeming it as added construction waste, then this would make real estate a more sustainable/wholesome practice. Rather than looking back at older valuations standards, how different would the sector be if we incorporated the value of circular interventions to the original value already calculated? Would there be a drastic difference and most importantly, would it change the way real estate investors looked at circularity. The fact that the value of the property at the end of life is expected to be higher than expected (under normal circumstances), is already incentive enough to consider this transition. To stretch the concept of circularity within the pre-existing valuation methods, it is first vital to understand them well, decipher what lacks, and then create a matrix to see how these can accommodate values of circular principles. Will these be permanent incisions, or very case-specific, or will they have no impact at all? This leads us to the main research question.

1.3 Research Question

This is an exploratory research, and the prime objective is to realize how the Real Estate sector can incorporate Circularity within their existing framework, specifically within the valuation of real estate properties. It is important to understand why this research chooses to focus on addressing current valuation methods, rather than aim at providing a new methodology. To create a new methodology altogether, there are various parameters to be considered, in terms of EU regulations, compliances, and discussions with different boards. The focus would then incline towards aligning thoughts and arriving at a final consensus with all stakeholders, which would take years. Hence, to enable a smooth transition, it is easier to do so in a familiar domain for valuators, to make it effective and relatable.

For that, the first step would be to understand the current methods of valuation and how accepting they would be to interventions that enhance circularity. Simultaneously, it is essential to realize why the Real Estate domain has not already shown substantial progress in terms of making the switch from a linear to a circular model. Once this has been established, the next task would be to create a bridge between circular principles and valuation standards, to test (via literature, interviews, and surveys) whether circularity can be established within valuation practices or not. Based on all these parameters, the research arrives at the following question.

How can Circular Strategies be implemented in current Real Estate Valuation practices?

Based on this, sub-questions are addressed, which build up to help answer the primary question of the research.

1. What is the Circular Economy, specifically within the Built Environment?
2. What are the current methods of Real Estate Valuation for commercial, office properties, and what is the link with Circularity?
3. What kind of stakeholders are involved in the process of Real Estate Valuation, and what role do they play in this industry?
4. What are the primary opportunities and barriers encountered in this transition?

These questions create an interesting and much-needed storyline to finally arrive at the main research topic. To know the impact of circular design on real estate values, there first needs to be clarity about what the circular economy is, what are its principles as well as its applicability in the built environment. The research then eases into a theory about the Dutch investment market, followed by methods of valuation. It is from here that parameters for valuation are extracted and analyzed. At this point, a link is created between the two main themes. Since the methodology will be based on interviews, it is necessary to explore the type of interviewees and their role in this industry. All this will lead to a more thorough output for the final research question.

1.4 Scope and Limitations

Determining the scope of the research is critical since it clarifies the area in which the research will take place, allowing for dedicated knowledge within that domain in the end. This study is being done in collaboration with Copper8 for a planned duration of 26 weeks, with 32 hours of work each week, which initiates some limitations on the scope of the project.

The research will focus on valuation methodologies within the commercial real estate sector. Since this is also quite broad and different categories of commercial properties have varied valuation methods as well as parameters, the emphasis will be on office buildings. This is one sector that is perennial and is always in demand, as well as comprises scope for innovation. COVID-19 has impacted the office real estate market substantially, where various properties fell vacant. In such a situation, it would be interesting and important to understand how circularity can play a role in addressing this turnaround.

An important aspect of the scope is to see at which stage of the construction this research will dwell. The following diagram will help with understanding the same.

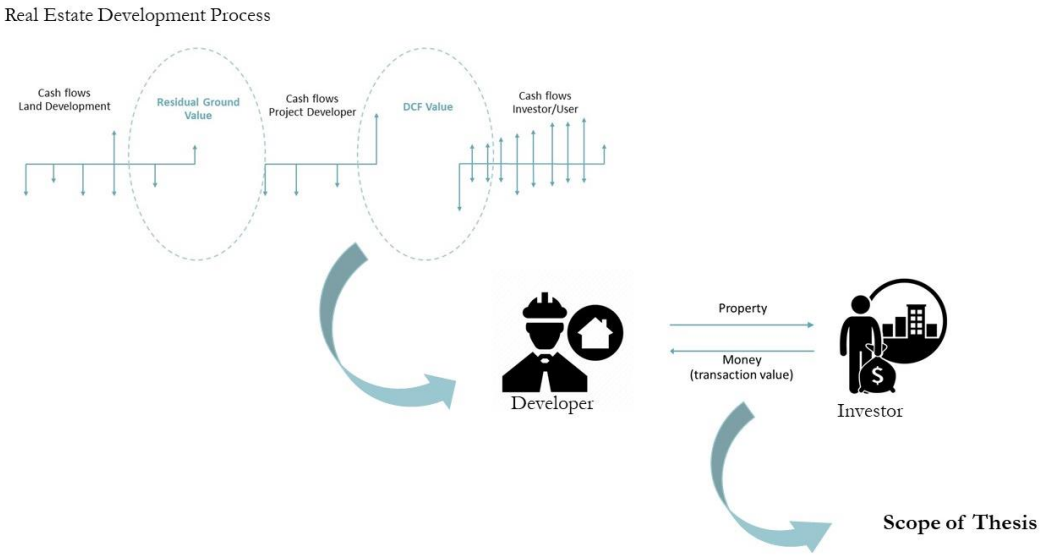


Figure 2: Scope of the thesis research domain; own figure

The first part of the diagram depicts transaction phases between a barren land and the developer, while the second DCF depicts the transaction between the developer and the investor, which usually takes place post-construction. This thesis will focus on the transaction value in the latter half. Hence, what impact would circular interventions (if included) in the project have on the market value determined when sold to the investor- that will be the emphasis. While it is known that often the transaction price between two parties need not be the same as the market value determined, the market value still plays a crucial role in arriving at the final transaction value.

Another aspect to note is that since this research is an exploration in a new domain, there is not enough prior literature to strongly support the same. Hence, the results, conclusions, and recommendations will be based on the outcomes of the interviews and survey conducted. Although validated by experts, the results obtained might lack stronger literature backing. Additionally, since the main theme revolves around valuation, this research will be addressed from a Real Estate Valuators' perspective, in terms of how he/she can include circular principles in his/her calculations.

1.5 Relevance

"The property business is at a tipping point on its path to a sustainable future" (Chadwick, 2019).

The government recently introduced an amendment to the 2008 Climate Change Act to lift the Netherlands' carbon emission target from 80 percent to 100 percent by 2050. The World Resources Institute unveiled the Zero Carbon Buildings for all initiatives at the UN Climate Summit in September. This implies that the rules have already been set, and the industry is urging businesses towards a regulatory environment with a growing pace where sustainable and circular buildings are the new normal. Landowners and developers risk missing out by failing to recognize the opportunities raised by these sustainability trends now (Chadwick, 2019).

As more developers, owners, and tenants adopt environmentally friendly strategies that lead to lower maintenance costs and higher property prices, the business case and relevance for environmentally sustainable construction and operation has never been greater.

1.5.1 The interest taken by Investors

For a commercial real estate investor, his prime objective is to generate high revenue, while keeping a tab on balancing out his risks. There is strong reason to believe that these investors can derive substantial benefits by investing in circular economy practices. It is also important for them to realize that the building might be rendered antiquated in the future if it is not designed for sustainability and longevity, leading to heavy losses. Sustainable investments result in returns in the form of larger occupancy and higher rental income.

The idea of publicizing and releasing reports of an investor's circular ambitions increases their desire to fulfill it. Hence, due to various sustainability indicators and as a part of their corporate social responsibilities, companies need to highlight their yearly contributions towards creating a positive social impact. Additionally, the advent of Integrated Reporting offers an incentive for property owners to create an evidence-based analysis of how synchronized financial and non-financial capital management generates value for their financial capital suppliers through their investment processes (Breakthrough for sustainability in commercial real estate, 2014).

1.5.2 Government Initiatives

The Netherlands Government has strong visions of developing Circularity in the Netherlands by 2050. The Cabinet has taken responsibility for putting in motion measures aimed at achieving this purpose. In addition to its position as market regulator and network partner, with its eye on promising opportunities and a device strategy, the Cabinet wants to facilitate the transition to a circular economy. Knowing this, the companies that want to switch towards a circular organization will get support from the government in this endeavor. Additionally, as already mentioned, companies need to declare their reports of energy consumptions and savings for the year, which drives them that extra mile to do a satisfactory job. For example, JLL publishes an annual sustainability report where they elaborate on their sustainability goals, a vision ahead, and how best they can contribute to society.

1.5.3 Materials and Built Environment

As per a statement by New Horizon, in time, the cost of construction raw materials will increase by as high as 70% more than the original cost. According to Michel Baars, the founder, and director of New Horizon Urban Mining, this will lead to greater opportunities for circular interventions, wherein materials will be taken from the built environment, and not from the Earth's natural reserve. Currently, in real estate, only three percent of its actual commercial worth is signified by the raw materials and other building materials it contains. This calls for a technique to measure the residual value of products, to account for it in the value of commercial properties.

1.6 Research Method

Since in this project, the understanding of what already exists plays a vital role, the most appropriate way to decipher what real estate investors/ valuators have to say about introducing circularity is by conducting interviews and questionnaires. This way, there is an understanding of what stage each company is at, along with what their interpretation of circularity is. Such interactions will also enable an evaluation of why certain methodologies have not been adopted yet, or do not provide the desired output. Once these have been assessed, solutions can be recommended.

A data collection for decision-making among isolated, anonymous respondents is the *Delphi method.* It aims to direct group views towards a final decision and to answer questions by triangulating subjective group decisions, analytical techniques, and the researcher's experience (Cantrill, Sibbaldand Buetow, 1996). This is a multistage procedure, where each level is built on the previous one. As part of a process that seeks to inspire respondents to think about the complexities of the issue and develop concrete, high-quality ideas, all stakeholders provide detailed statements.

The target group is a myriad of stakeholders that are involved in the Real Estate Industry. This enables us to get the whole picture, from different perspectives. Certain outcomes tend to be complementary to the other, which will aid in stitching the story together. In case some outcomes do not match with the rest; it would then be easier to point out issues in the industry.

This questionnaire is usually anonymous to different parties when they review the answers. The primary cause for this is to provide freedom of expression, without hesitations of being noticed for bold statements.

1.7 Report Outline

The report can be divided into four phases for the ease of achieving a natural flow.

Phase 1: Literature Study

Post discussion of the research's broader context and importance, as well as the research purpose, scope, question(s), and research strategy, the first phase consists of a theoretical background to understand key definitions and concepts required for the study. It presents a theoretical background on the importance of transitioning to the Circular Economy by first highlighting what it is in the context of the built environment, and then describes the principles of design used for circular interventions. Following that, the methods of valuation and factors considered to arrive at it are elaborated upon. The fundamental goal here is to create a literature-based framework that can be used to gather the necessary initiatives for the research's significant progress.

Phase 2: Methodology

Phase 1's findings will serve as the foundation for the second phase of research. It identifies a research approach that is seen to be appropriate for gathering and investigating more data regarding the use of

circular economy methodologies in the valuation process. The Delphi technique is the chosen method used to arrive at a consensual result. Semi-structured interviews, followed by surveys, are conducted with professionals for a market-based perspective of circular activities and how they can be implemented within valuation practices.

Phase 3: Results and Analysis

The next phase elaborates on the analysis of the interviews to diagnose the additions, changes, or improvements required in the current practice of property assessment. The second portion of the chapter delves deeper into the development and validation of a strategy for improving current practices by incorporating circular economy ideas. Each parameter of valuation is studied, and analyses are provided based on interviews and surveys conducted.

Phase 4: Conclusions, Limitations, and Further Recommendations

Finally, the last section proposes a conversation in which the conclusions, limitations, and recommendations, are critically analyzed, which will capture the essence of this research.

INTRODUCTION	RESEARCH TOPIC PROBLEM ANALYSIS RESEARCH QUESTION SCOPE AND LIMITATIONS RELEVANCE RESEARCH METHODOLOGY REPORT OUTLINE
LITERATURE REVIEW	WHAT IS THE CIRCULAR ENVIRONMENT? SPECIFICALLY, WITHIN THE BUILT ENVIRONMENT WHAT ARE THE CURRENT METHODS FOR VALUATION OF COMMERCIAL, OFFICE PROPERTIES? WHAT STAKEHOLDERS ARE INVOLVED IN THE INDUSTRY, AND WHAT ROLE DO THEY PLAY IN SHAPING IT? WHAT IS THE INFLUENCE OF CIRCULAR DESIGN/ PRINCIPLES ON THE VALUATION PROCESS?
METHODOLOGY	QUALITATIVE – EXPLORATORY SELECTION OF CANDIDATES SEMI – STRUCTURED INTERVIEWS
RESULTS	ANALYSIS AND INTERPRETATION OF RESULTS BARRIERS AND OPPORTUNITES IDENTIFIED RELATIONSHIP BETWEEN CIRCULAR PRINCIPLES AND VALUATION PARAMETERS GUIDELINES FOR VALUATORS
DISCUSSION	IMPLICATION OF THE RESEARCH LIMITATIONS OF THE RESEARCH FURTHER RECOMMENDATIONS FOR FUTURE RESEARCH

Table 1: Research Framework

2. Theoretical Background

2.1 Circular Economy

The central idea motivating this research is the concept of Circular Economy (CE). Before delving into the application of CE in the context of Real Estate (RE), it's critical to first grasp the theory's meaning, associated concepts, and the need for such a transformation. This chapter begins with the analysis of CE theory as a basis, followed by a brief literature assessment of its relationship to the built environment and the real estate industry. Finally, the principles are expanded upon in order to make a link with the RE Valuation parameters, which will be discussed in the second half of the theoretical background.

2.1.1 Introduction

The UN's Sustainable Development Goals (United Nations Sustainable Development, 2018) have drawn international attention to the circular economy (figure 3). The circular economy has the potential to allow for continued economic growth while minimizing environmental impact. A shift from a linear to a circular economy has been proposed as a more sustainable model that maximizes resource reuse and keeps materials flowing (Advisory Board, 2017; Ellen MacArthur Foundation, 2013). A paradigm shift is needed to transition from a linear to a circular economy. As a result, we must reconsider how we use, manufacture, and design.

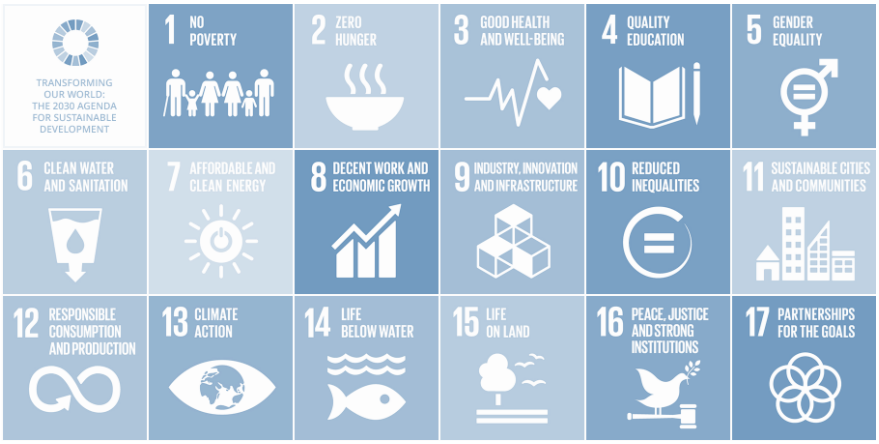


Figure 3: UN's Sustainable Development Goals (sustainabledevelopment.un.org)

The circular economy does not yet have a standard definition. Many scholars, however, accept that the circular economy outlines a business model and the concept of a closed loop. The circular economy is described by the Ellen MacArthur Foundation as "an industrial system that is restorative or regenerative by intention and design" (Ellen MacArthur Foundation, 2013, p.6). Furthermore, Geissdoerfer et al. (2016) investigated various concepts of circular economy and discovered similar elements in each. They then condensed it into a single definition: "a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling." (Geissdoerfer et al., 2016, p.759). Figure 4 gives a diagrammatic explanation of how the Circular Economy primarily works.

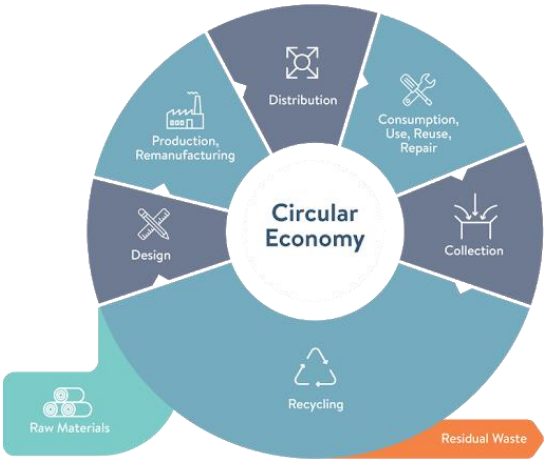


Figure 4: What is the Circular Economy; "What is the Circular Economy? | Rediscovery Centre"

Defining the circular economy is also extremely context-dependent, as what you are trying to achieve at a micro (products, businesses, consumers) level differs from what you are trying to achieve at a macro (city, area, nation) level. To make the transition easier, all project stakeholders must agree on the main points that are unique to the project (van Oppen et al., 2018) based on the identified core principles. The Ellen MacArthur Foundation has established three key principles of CE, which are described below (Ellen MacArthur Foundation, 2017)

1. *Design out Waste and Pollution:*
   In a circular economy, the negative impacts of economic activity that harm human health and the environment are revealed and designed out. This includes greenhouse gas and hazardous chemical emissions, as well as air, soil, and water pollution, as well as systemic waste, such as traffic congestion.
2. *Keep Products and Materials in Use:*
   In a circular economy, initiatives that retain value in the form of resources, labor, and materials are valued. Designers must consider lifetime, reuse, remanufacturing, and recycling to keep components and materials flowing in the economy. Circular systems make it easier to use bio-based resources by supporting a wide range of applications as they circulate between the economy and natural systems.
3. *Regenerate Natural Systems:*
   A circular economy avoids the use of non-renewable resources while maintaining or improving renewable ones, such as returning critical nutrients to the soil to help regeneration or using renewable energy instead of fossil fuels.

2.1.2 The Opportunity of a Circular Built Environment and Real Estate

The built environment, which includes man-made components like various infrastructure, is currently a major global user of natural resources and a large contributor to global carbon emissions. This is because the built environment in which we live today is still based on the linear 'take-make-dispose' model, in which materials are sourced, used, and then discarded (Acharya, Boyd, and Finch, 2020). As a result, construction materials and the construction industry consume more than a third of all global resources. Furthermore, existing estimates suggest that by 2060, the equivalent of a city the size of Paris will be constructed every week around the world (Hamilton and Raph, 2020). With current trends, carbon emissions from construction are expected to account for nearly half of all new building emissions between now and 2050 (New Buildings: Embodied Carbon – Architecture 2030, 2019).

With these considerations in mind, Circular Economy (CE) in the built environment is a strategy for reducing waste production and resource depletion (Circle economy, 2017). It is important to carefully plan

buildings so that materials always flow in a circular pattern. When it comes to CE in the built environment, it is important to recognize not only new or soon-to-be-built buildings but also existing supplies. According to reports, 75-90 percent of the current building supply in northern hemisphere countries was still standing in 2015 due to their long lifespan. According to reports, approximately 80% of buildings were constructed before the 1960s, implying that the structures would last at least 60-90 years (Pomponi & Moncaster, 2017). As a result, focusing solely on greenfield developments would not suffice if CE were to be realized in buildings. This is where the circular economy will influence how things have been done previously. Figure 5 depicts how the CE in the built environment would look like.

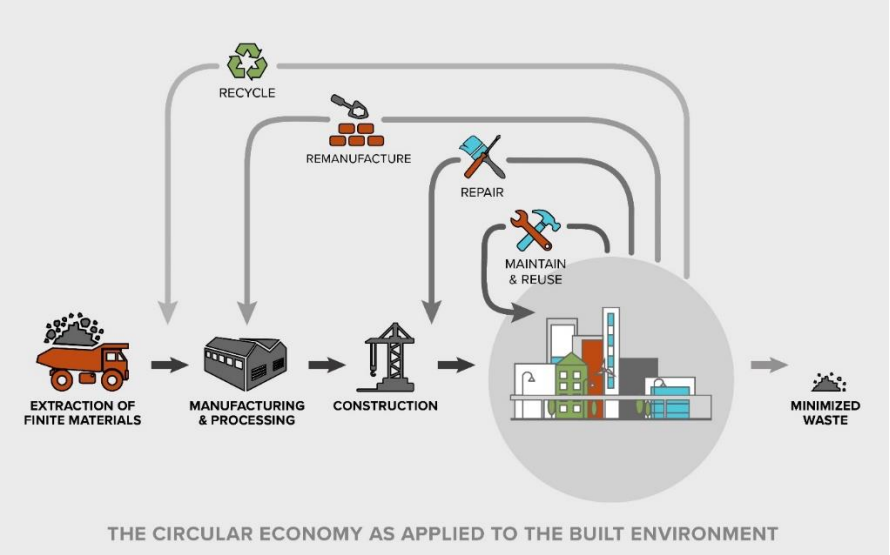


Figure 5: The Circular Economy in the BE; Waste Less, Reuse More | Hickok Cole, 2020

Real estate is one of the few commodities that lasts a lifetime. For decades, monumental structures have been in use. Very few other products have such a long shelf life (van Sante, 2017). Below are certain ways in which the Circular Economy can be imbibed in Real Estate long-lasting structures.

- Circular design aims to restore as much of a building's economic, social, and ecological value as possible during the adaptive reuse process. Adaptive reuse's potential advantages are based on the ability to remove parts from an outdated building and recycle, restore, reuse, or remanufacture them.
- Successful building maintenance is critical to circular construction activities because it preserves the integrity and value of investments, keeps the building in a condition that allows it to fulfill its mission, and presents a good outer shell (Pukite & Geipele, 2017).
- Multiple activities at local, regional, national, and global scales are needed to develop a circular economy. All stakeholders must adopt six key circular economy acts to transform and contribute to a more sustainable way of life. They are regenerate, share, optimize, loop, virtualize, and exchange. Each of them will briefly be defined below.
    - Regeneration refers to the transition to renewable energy sources, the restoration of ecosystem health, and the return of recovered biological resources to the biosphere.
    - Sharing refers to optimizing product use through peer-to-peer sharing of privately owned products or public sharing of product pools; reusing products during their technological life spans and expanding these life spans through maintenance, repair, and durable design.
    - In the sense of the circular economy, optimizing means enhancing product output and productivity, eliminating waste from supply chains, and using big data and automation.
    - Looping is the process of holding finite and reusable components and materials in closed loops.
    - Virtualization refers to the delivery of services over the internet, such as books, music, online shopping, and digital offices.

- Exchanging refers to the replacement of old materials with advanced green materials, as well as the application of emerging technologies such as electric motors and 4-D printing.

- The entire supply chain must be involved to achieve circular construction in practice. Architects and developers, for example, must determine whether to reuse or demolish an old structure. Bio-based building materials should be available from construction suppliers. Smart demolition helps demolishers to repurpose high-quality used construction materials. Wholesalers may be acting as resource banks by selling used products (van Sante, 2017).

Circular construction is related to aspects of flexibility, health, real estate as raw materials stock, and societal benefits, as shown in Figure 6. Circular architecture should focus on adaptable infrastructure and real estate constructed from non-toxic, environmentally friendly, and recyclable materials. Real estate objects should be able to be repurposed quickly. They can be thought of as a stockpile of raw materials. Renewable energy sources, whether integrated with real estate objects or generated nearby, should be considered the primary energy source.

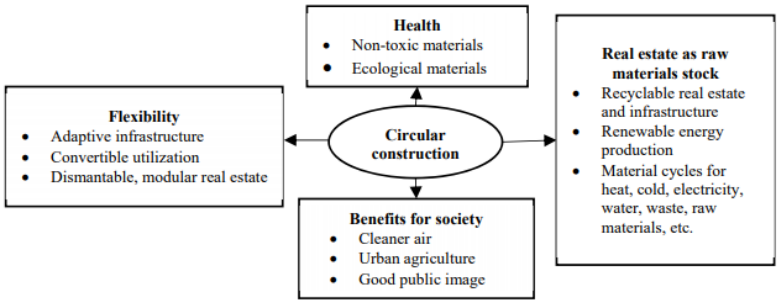


Figure 6: Advantages of circular construction implementation (Zvirgzdins, J.; Plotka, K.; Geipele, S. 2019. Circular economy in built environment and real estate industry)

2.1.3 Circular Buildings

A typical circular building, according to Stewart Brand, has six layers that are classified into functionality and functional lifespan: site, structure, skin, services, space plan, and stuff. This is depicted in Figure 7. Shearing layers have a variety of lifespans: Installations typically last 7 to 15 years, and a facade often 20-40 years. Each shear layer prioritizes additional circular principles to add substance to circular construction due to variances in functionality and service life. This concept can be vital to valuators in terms of valuating modular buildings based on their different layers and characteristics.

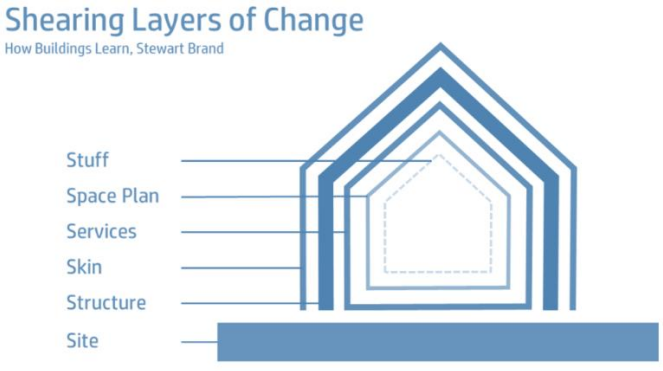


Figure 7: Shearing layers of a building (Brand, 1994)

2.1.3.1 Circular Building Principles

Circularity is accompanied by concepts or principles, that help translate theoretical definitions into practical examples. There are four broad categories of principles that have been identified, which will help set basis

for the further sub-division, to arrive at practical, easy to comprehend principles of the Circular Economy that are applied in buildings to make them more sustainable. They are elaborated below.

Using fewer products, components, resources, and energy during design and manufacture, as well as distribution, use, and recovery, is referred to as ***Narrowing.*** (Konietzko, J., Bocken, N., & Hultink, E. J.,2020). Translating this to the circular built environment, the term 'narrow' refers to a building's usage of fewer resources over its lifetime. In this regard, the early design phase is crucial, because design decisions have an impact on the performance of buildings and their operations in later stages (Çetin, Sultan & De Wolf, Catherine & Bocken, Nancy.,2021).

Slowing refers to using products, components, and materials longer (Konietzko, J., Bocken, N., & Hultink, E. J.,2020). Through design and operational techniques, the slowing resource loops approach aims to slow down resource flows by intensifying their utilization and extending their beneficial service life (Çetin, Sultan & De Wolf, Catherine & Bocken, Nancy.,2021).

When buildings reach the end of their useful lives, the ***closing*** resource loops principle tries to reintroduce resources into the economic cycle (Çetin, Sultan & De Wolf, Catherine & Bocken, Nancy.,2021).

Regenerating is a type of business that manages and supports natural ecosystem services while also using renewable and nontoxic materials and running on renewable energy. Regenerative architecture is regarded to be the pinnacle of architectural sustainability, going beyond green and sustainable building ideals to provide self-sufficient, continuous flows of resources, in which human-nature co-evolutionary systems are begun based on the features of the location (Çetin, Sultan & De Wolf, Catherine & Bocken, Nancy.,2021).

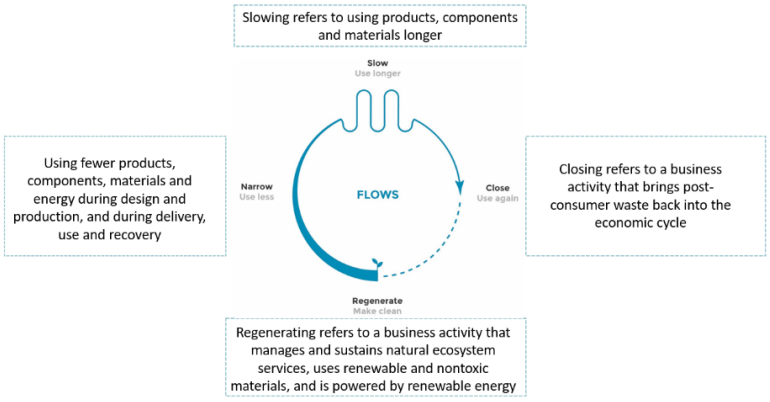


Figure 8: Principles of the Circular Economy; Çetin, Sultan & De Wolf, Catherine & Bocken, Nancy.,2021

Each of these design strategies can further be sub-categorized into 8 building principles (Copper8, 2021. Scenarios of how each of them can be applied in the research are elaborated upon below as well.

Regenerate

- Increase the quantity of (sustainable) bio-based materials
- Maximize the potential for high-quality reuse, if materials are appropriate for reuse due to their high quality or lack of harmful substances, for example.

Narrow

- Use as little material as possible to reduce the amount of raw resources consumed.
- Reduce the amount of 'new' (virgin) material used.

Slow

- Design for a maximum functional life
- Design for optimal use and maintenance.

Close

- Design for future life cycles.
- Increase the amount of recycled material while retaining the value of products and materials that have been discharged.

Although there are different ways in which principles can be worded, the above list is a comprehensive set of circular building principles that are used in one or more ways in different sustainable projects. Each of them have already been analyzed to understand how they can be measured, and are practically oriented to they can be applied directly in projects. The principles focus on most parameters of design, including usage of adequate materials, flexibility, and adaptability, building harvesting, an extension of usability, and reusability, among others.

The first step to establishing a connection between the two themes (CE and RE Valuations) is to understand some examples of scenarios in the practical world where these circular principles are applicable. This will be predominantly helpful for valuators to strike a connection and recognize circular design strategies when they see it in a building since it is not directly their area of expertise. These examples are also meant to be a basis for valuators as well as developers to think further in the sustainable direction. Each principle has been explained below.

It is important to address the level of perspective from which the following eight principles are looked at. One can look at circularity from a material, product, component, or building level. Depending on the level, the principles could (not necessarily) have slightly different nuances. In this research we look at the valuation of the building as a whole, thus it is logical to look at the circular principles from a building level as well. It is important to keep this in mind while reading about the circular principles and its impact on the valuation parameters. The examples elucidated are from this same building-level perspective.

1. Maximize the potential for high quality reuse

- Reuse of components implies that there is lesser extraction and use of new materials, leading to advantages for the developer, as well as investors. When materials are reused, it is important that they are classified as safe to be reused. When solely focussing on reusing materials, there is risk that toxic materials are being reused, while you would rather not reuse them at all. A clear example is that asbestos should not be reused in any way. Additionally, reusing car tires is not a good example as well, as the rubber will still evaporate volatile organic compounds in the air leading to low air quality. One should always be careful of the materials that are put into a building to maximize the potential for high quality reuse. Cradle2Cradle made a banned list of chemicals which entails materials that should not be used in buildings
- Reusing materials can pertain to the usage of elements such as non-toxic, ***modular*** partitions walls and facades, staircases, scaffoldings, doors and windows, and roof claddings. These can be more in demand if companies incentivize component returns. Additionally, ***designing for demountable and adaptable uses*** will make it easier to reuse components without losing too much value over the years.

2. Maximize the amount of sustainable (low carbon footprint, bio-based) materials

A method of preventing the use of new virgin materials that are finite, is by using biobased materials. Biobased materials are materials that grow in nature, such as hemp and wood. In theory, they materials can be used endlessly. Another benefit of biobased materials is the fact that during their growth process, they take up CO_2 from the air, leading to a low carbon footprint.

- To give an example of a bio-based material for construction***, Bamboo*** is widely acknowledged as one of the most ***environmentally friendly building materials*** available. It has an incredible rate of self-generation, with some species growing up to three feet in 24 hours. Bamboo is a perennial

grass, not wood, and once harvested, it continues to spread and grow without needing to be replanted. Bamboo has a high strength-to-weight ratio and outstanding longevity — it has even more compressive strength than brick or concrete — so it can withstand a lot of abuse without needing to be replaced frequently. As a result, bamboo is an attractive option for flooring and cabinetry. Bamboo requires less energy to transport than many other materials of equivalent durability due to its light weight.

3. Minimize the amount of new (virgin) materials

The central goal of circularity is to minimize, and eventually stop the use of virgin materials, as they are not infinite. Though it might look similar to the principle 'design with minimum amount of materials', there is a slight difference. With this principle the focus is solely on minimizing the amount of virgin materials, not minimizing the total use of materials. It could be the case that in order to minimize the amount of virgin materials, more secondary or biobased materials are needed. This, for example, could be caused by oversizing the structure due to safety regulations of secondary materials, possibly leading to more total use of materials, even though the amount of new (virgin) materials is less. For example, as described below, a standard building composition can entail 250kgs of bio-based materials, 250kgs of reused materials, and 1000kgs of virgin materials. The goal is to lower the quantity (by weight) of virgin materials, even if the overall weight of the building does not reduce.

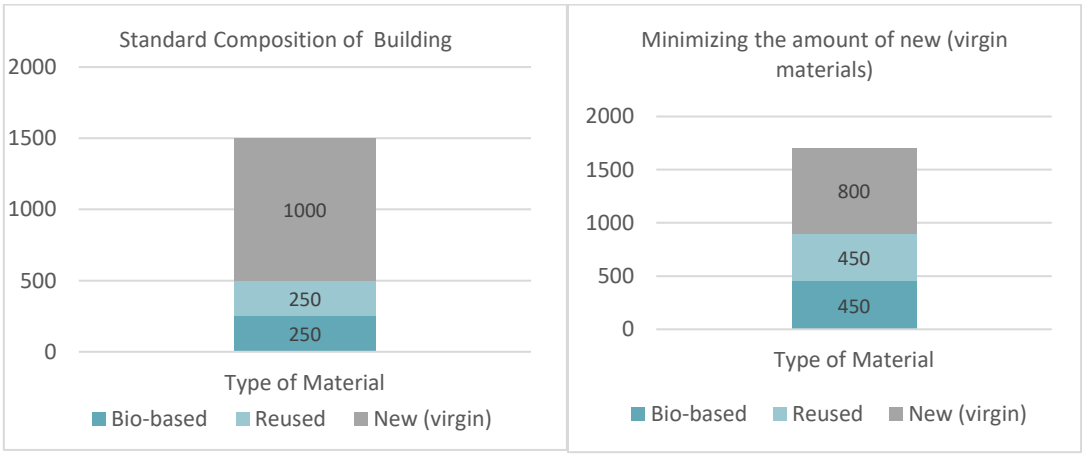


Figure 9: Depiction of reducing the amount of virgin materials

- Some examples include the ***Reduction of the quantity*** of raw steel used in structural frames, the amount of concrete used to make solid slabs, and even ***avoiding extra rooms*** in the space planning by assessing their added functions will create a substantial impact.
- Additionally, the option of ***sharing construction resources*** instead of purchasing them individually can encourage vast savings. Companies can come to arrangements to collaborate and procure them together.

4. Design with minimum amount of materials/components

Designing with a minimum amount of materials/components is similar, yet different from minimizing the use of virgin materials. With this circular principle the focus is to minimize the total amount of used materials. This can be achieved by optimizing the design by using tools for topological optimizations.

The aim is to reduce the materials used in a construction project. For example, as described below, a standard building composition can entail 250kgs of bio-based materials, 250kgs of reused materials, and 1000kgs of virgin materials. The goal is to lower the quantity (by weight) of either/all components, impacting the overall quantity of materials used, which will in turn help reduce costs.

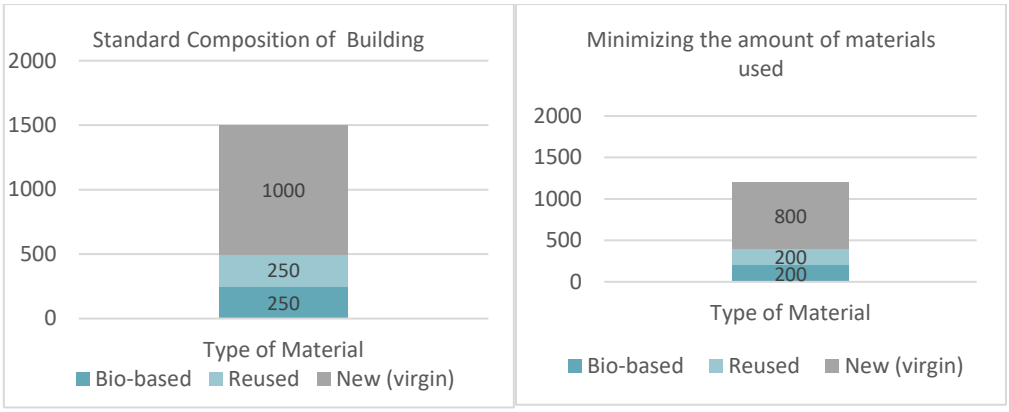


Figure 10: Depiction of reducing the amount of materials

- With the help of ***topological optimizations***, it is possible to analyze where consumption of materials can be minimized; that is, it helps ***optimize lightweight structures***. Topology optimization is a mathematical method for maximizing the performance of a system by optimizing material layout inside a given design area, for a particular set of loads, boundary conditions, and restrictions. Modular buildings have several advantages, including lower fabrication costs, faster construction times, and superior quality control. Existing topology optimization methods could be extended to aid in the effective design of modular structures as these structures become more prevalent in modern structural engineering.
- Another factor is to make a conscious ***choice to use renewable materials and energy*** for construction as well as redevelopments. For example, deep energy renovation of old houses. A deep energy retrofit is a type of energy conservation technique implemented in an existing building that results in an overall increase in the structure's performance. It is defined as a whole-building analysis and construction process to reduce on-site energy consumption in a structure by 50% or more compared to baseline energy use using existing technologies.

5. Design for maximum functional lifetime

The most circular building is one that is used in the same location endlessly, like the canal houses in Amsterdam which have been used as warehouses, stores, offices, and residents. Until now the inside of those buildings has been altered and adapted to the functional need of the time, while the structure and skin of the building remained intact. It is crucial to design a building that is not optimized for one specific function at one specific moment in time, to maximize the functional lifetime.
Buildings need to have a robust structure (and possibly skin), while the other shearing layers (services, space plan and possibly skin) can be changed easily. Standardization of measurements, demountable connections and modularity are key factors in designing a building for a maximum functional lifetime. Below are certain examples of how it can be implemented.

- The circulation of resources occurs on spatial, structural, and material levels, and it has two main domains: One, ***spatial reversibility*** refers to the ability to functionally transform spaces without causing significant resource consumption, e.g., transforming an office into a classroom; secondly, ***technical reversibility*** addresses how structural and material arrangements are made to allow the reuse of building parts in the future. Designing interlocking connections between components, for example, to allow for easy disassembly.
- A suggestion is also to ***sub-let office spaces*** to other similar-sized companies who work at different office hours, which will work out well to maximize on available facilities.

6. Design for optimal management and maintenance

Operation, Maintenance, and Repair Costs are greater than three times the cost of initial construction. Having such a profound impact, it is important that operations and maintenance considerations are discussed at the beginning of construction to optimize the life cycle of a building.

- It can be obtained by the usage of automated systems like the ***Building Management Systems*** designed to optimize energy usage, space planning, etc. An example is what the company 3XN in Denmark does. They study behavioral design and apply it in projects to optimize all facilities in the building.
- Additionally, an option is to provide functionality or services in the form ***of a lease rather than ownership***. This is what the product as a service model is based on and is picking up interest in various fields.

7. Design for multiple life cycles

Whenever a building cannot stay at the same location, it should be reused in the most valuable way. In order of preference, reusing the building entirely, at a new location, reusing the components of a building (entire façade) in new buildings, reusing the products of a building (windows) in new buildings and lastly, reusing the materials in new buildings can be considered. In order to reuse in the most valuable way, it is important to design in a way that products can be easily demounted.

- A way to achieve it is by designing for ***demountable and adaptable structures***; for example, UMAR project. The NEST research facility on the grounds of the Swiss Federal Laboratories for Materials Science and Technology (Empa) in Dübendorf, Switzerland, houses the Urban Mining and Recycling (UMAR) Experimental Unit. The project is based on the idea that all the materials used to make a structure should be entirely reused, recyclable, or biodegradable. This puts life cycle thinking front and center in the design: Instead of simply using and discarding resources, they are borrowed for some time from their technical and biological cycles before being put back into circulation again.

8. Maximizing the amount of reused materials

Buildings can be constructed with either new (virgin) materials or secondary reused materials. Building with reused materials has two benefits, it has a lower carbon footprint, and it prevents extraction of finite resources from the earth. Within the principle of reusing materials there are different levels of reuse (refer to figure of Value Hill). It is preferred to reuse materials with the highest value, which is as follows:

- Reuse of components (e.g., entire façade)
- Reuse of products (e.g., window as a whole)
- Reuse of materials (e.g., wood out of window frame)

- ***Industrial symbiosis*** is a way of maximizing reused materials in a project It is a concept that teamwork and synergetic relationships benefit from the trash or byproducts of several industries. For example, a recycling factory and a concrete production factory demonstrated industrial symbiosis based on recycled concrete aggregates.

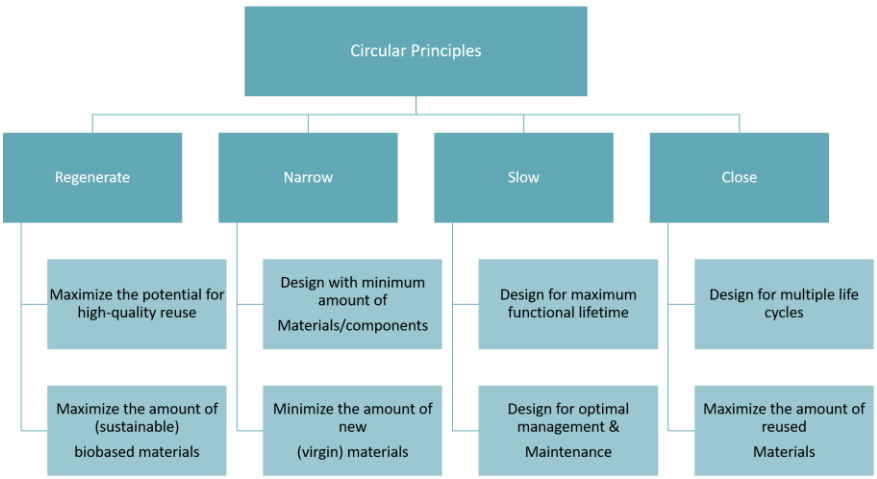


Figure 11: Circular building Principles (Çetin, Sultan & De Wolf, Catherine & Bocken, Nancy.,2021; Copper8); own figure

2.1.4 Importance of Circular Value and Value Hill

The circular economy's reasoning is sound, and it has numerous advantages for both our economy and society. Why then, is the transformation taking so long, given the projected benefits to our economy and society? According to research published by Circle Economy, the world is now just 8.6% circular, and progress in the shift has slowed. This shows that either the ability or the business case for transitioning is lacking.

Understanding the concept of value in the circular economy is critical to gauge its importance, to encourage industries to initiate the transition. Most businesses look for higher value in everything they do, hence, knowing how circularity adds value to a business will certainly make the transition easier.

2.1.4.1 What is Value?

Value can refer to a quantity or a number, but it is most commonly used in finance to judge an item's, a company's, or its financial performance's worth. A range of financial measurements are used by investors, stock analysts, and corporate leaders to assess and anticipate the worth of a company (Kenton, 2020).

Value is a concept in traditional economic theory that connects a client and a corporation through a chain of activities that leads to profit maximization. A company offers a product or service to a customer that benefits both parties. Value in the context of a business might be interpreted as profit. In today's world, value is expected to be received swiftly and to be fleeting.

2.1.5 The concept of the Value Hill in Circularity

Although there are several opportunities to invest in circular business models, standard investment approaches do not meet the needs of these unique companies.

Companies, as well as the financial industry, must adapt to finance these business models. Financiers must adjust their perceptions of the risks and opportunities connected with these models, and businesses must establish an appealing business model for them.

The Bruntland Report, titled "Our Common Future," published in 1987, introduced the notion of value recovery as the UN's first call for sustainable development. This notion is crucial from a sustainability standpoint, but it also makes sense from the perspective of commercial economics. When we contemplate why anyone would throw away something valuable, value recovery becomes one of the most important parts of sustainable development and the circular economy.

2.1.5.1 Value Hill in the Linear Economy

We have developed sophisticated ways to create, create, distribute, and sell things across the world. At every step of the process, value is added by gathering materials from the earth, purifying them for manufacturing, assembling them into products, and distributing them to consumers. However, when the consumer has finished using the goods, its value decreases (Achterberg, Hinfelaar, and Bocken, 2016).

Business models are typically sales-driven; therefore, profits are derived primarily from the sale of as many things as feasible. This offers an incentive for manufacturers to design items with a short life cycle to keep selling new ones (Achterberg, Hinfelaar, and Bocken, 2016). The value gained in the production process is swiftly destroyed when outdated products end up in landfills or are burnt. As a product is manufactured (the left side uphill slope), value is added, and as the product reaches the top of the hill, the product's value is at its peak. However, after a relatively brief lifecycle, the product's value is swiftly depleted, and value swiftly declines.

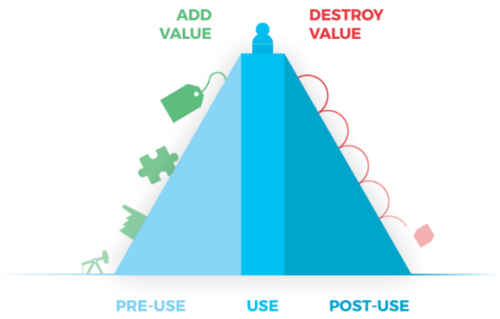


Figure 12: Value Hill in the Linear Economy; Achterberg, E., Hinfelaar, J., & Bocken, N. (2016). MASTER CIRCULAR BUSINESS WITH THE VALUE HILL. Circle Economy

2.1.5.2 Value Hill in the Circular Economy

The goal of circular enterprises is to keep a product's added value for as long as feasible, if not indefinitely. Value is added to the product as it advances "uphill," and circular tactics keep the product at its peak value (the top of the hill) for as long as possible. Products are built to be long-lasting and easy to maintain and repair, shortening resource loops and extending the product's usage phase (Bocken et al., 2016). When a product is ready to begin its descent, it is done as slowly as possible so that its beneficial resources can still be used by other systems.

To retain value, four main categories can be described on the value hill:

1. Circular Design
2. Optimal Use
3. Value Recovery
4. Network Organization

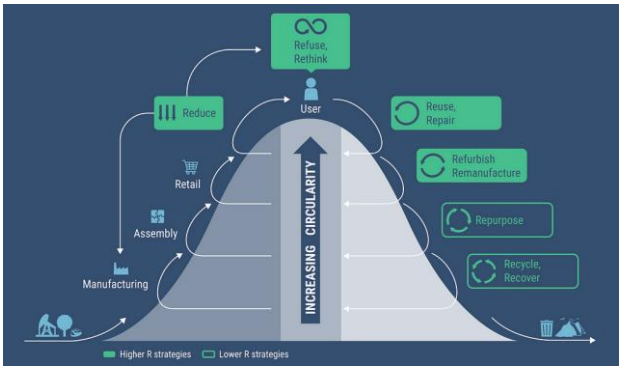


Figure 13: Value Hill in the Circular Economy; Corbin, L., & Black, K. (2021). New mechanisms for cities and finance to drive Dutch circular economy innovation

Uphill: Circular Design

Circular Design refers to commercial operations that take place before or during the design, manufacture, and distribution of a product. These operations are located on the Value Hill's upward slope and focus on extending the use phase (e.g., product lifetime), accounting for end-of-life appropriateness (e.g., modularity), reducing resource intensity, and repurposing existing goods, components, or materials.

Top hill: Optimal Use

The second category, Optimal Use, refers to a product's in-use phase. This category of business models aims to optimize the usage of a product by providing services or add-ons that extend the product's lifetime or provide ways to increase productivity. On the Value Hill, these company concepts are positioned at the top.

The product-service-system (PSS) model (Tukker, 2004) is a well-studied business model in which corporations develop bundles of products and services that are more valuable together than they are individual, giving them more control over their resources.

Downhill: Value Recovery

The third category, Value Recovery, is concerned with a product's post-use phase. These business concepts make money by harnessing the value of used products (which were formerly referred to as waste or by-products). Using recaptured materials, providing reconditioned items, selling used products, and aiding remanufacturing and recycling are all examples of value recovery.

Network Organisation: Managing of information, materials, and money flows

Network Organization is the final category, which includes corporate activities involving the administration and coordination of circular value networks. A circular network comprises the coordination and management of resource flows, as well as the optimization of incentives and other supporting activities.

2.1.5.3 Relevance in the research

In the current context and scenario, various organizations explore the residual values of materials in a project, such as Wearthie Taxatie, Residual Value Calculator, etc., as elaborated further in the report *(Current Circular Interventions).* As per the value hill, they represent the downhill or the value recovery phase, but the lower portion of that. There is little focus given to additional parameters of valuation that can entail circular practices, to help retain the value longer, before it reaches further down the recovery hill. As you go lower down the hill, the value that can be recovered reduces.

With this research, we aim to address the value retention as well as the value recovery stage, but at a higher point on the hill. There are various parameters of valuation, that when addressed and given attention to, have the potential to help achieve a higher value, as well as longer retention periods. These have not been given much importance yet in previous literature, hence this exploratory research will aim to provide a substantial start to it.

2.2 Real Estate Valuation

Now that there is a clear picture and understanding of the Circular Economy, the second part of the literature review dwells upon Real Estate in the Netherlands and its valuation practices. The focus will be on Dutch Commercial Markets and their methods of valuation. Once this is clear, a description of the importance of the inclusion of Circularity in this domain will be elucidated upon. Only after there is a thorough understanding of these principles, can we pave a way forward to dwell into the amalgamation of valuation parameters with circular principles and designs.

2.2.1 What is a property and the Economic Role of Valuators in Real Property Markets?

Real property is a particular economic good that differs significantly from other economic goods. To start with, Real Estate is described as a specific piece of land on the Earth's surface, as well as the semi-permanently attached items such as houses, trees, soil, and subsoil assets such as underground storage tanks (Bartke, Stephan, 2015). Real property encompasses all the interests that are linked to the property, in addition to the real estate itself. Future usage rights, lease rights, and easements are examples.
The real estate industry is heavily regulated around the world. There is almost no other good whose property rights are so well-defined and closely regulated, such as by public zoning laws. The exclusivity and singularity of a piece of land within an ecosystem (that may change over time) determine its usability, which affects its economic value.

2.2.2 What is the Real Property Market?

As previously mentioned, real estate is an economic good for which given property rights exist and are implemented in most parts of the world. As a result, for property to be exchanged between individuals, a safe 'legal environment' for real estate transactions is needed. This environment can be called a property market. According to its legal framework, the real estate sector can be divided into residential, commercial, and public interests, as well as different submarkets.
Decentralized trade characterizes all these markets, particularly when a piece of real estate is to be used for building or cultivation rather than just as a financial investment. Furthermore, since real estate necessitates long-term, large-scale investments, it is not purchased (or sold) daily, especially when compared against consumer goods. As a result, we have markets where trade occurs in a relatively irregular manner. As a result, neither fair expectations nor a clear market point can be found among individual buyers or sellers; in other words, assets are exchanged in multiple dispersed locations rather than a single central location like a stock exchange, and this trade is characterized by complexity.

2.2.3 The Dutch Economy and Investment Market

2.2.3.1 Introduction

According to an article by Bouwinvest, the Dutch Economy has had one of the highest growth rates amongst all western European countries. Up until 2018, on a year-on-year basis, the Netherlands outperformed the Eurozone in GDP growth. This growth was predominantly driven by domestic spending. Consumers have spent more money in the last 17 years as compared to previous years. Across all business sectors, construction companies recorded the biggest increase in production in the first quarter of 2018, driven primarily by the construction of new homes (Bouwinvest.com. n.d. *The playing field for real estate investors in the Netherlands*).

2.2.3.2 The Dutch Investment Market

When focused on the Dutch Investment Market, within continental Europe, the Netherlands is the third most popular destination for real estate investors. There are signals that foreign investors will continue to favor the Netherlands. The openness of the Dutch real estate market, the country's strong economy, and the fact that prices remain competitive as compared to neighboring countries all contribute to this ongoing interest (Bouwinvest.com. n.d. *The playing field for real estate investors in the Netherlands*).

Concerning sustainable real estate, investments have been gaining traction around the world, though the rate of adoption varies by country. For institutional investors, the value of impact investing and Environmental and Social Governance (ESG) guidelines is growing, and Dutch players are at the forefront of this trend. Global awareness of the need to reduce CO2 emissions is increasing, and businesses and organizations in the built environment in the Netherlands are working to adapt. To the demands to adapt to the challenges of climate change, climate adaptation is both a challenge and an opportunity.

To make considerable progress in the investment of sustainable buildings, however, the investment industry requires substantial financial proof, which can only be achieved by modifying valuation technique to appropriately analyze sustainable office buildings. Evidence on the economic benefits of sustainable property investment is needed to persuade business practices, educate public discourse, and transform sustainable building markets, according to Lorenz (2007a). Investors need to know their estimated return on investment, expected income stream, and market value or selling price of their asset (Myers, Reed, and Robinson, 2008). All these variables influence investment decisions.

2.2.4 The Dutch Commercial Office Market

After the financial crisis of 2007-2008, commercial real estate regained its appeal, with almost all institutional investors, including credit institutions, insurance firms, hedge funds, and even government agencies, continuing to invest in real estate properties (Alina Nichiforeanu, 2017).

The Dutch office market is viewed as quite possibly the most developed and straightforward office market in Europe. Even though its verifiable advancement burdens the insight since improvements in non-focal areas have pushed opening step up before, ongoing business sector advancements have taken an assortment of Dutch business sectors back to financial backers' consideration (Bosma, Theuvenet and Landkroon, 2020). The Dutch office spaces offer a substantial and stable income to its investors.

Concerning the old buildings and the ones that were slightly outdated and no longer meet modern-day requirements, many have been successfully converted into residential, hotels, and student housing, accounting for the major transformation the Dutch market has undergone. For example, the former Admiraliteit offices have been renovated into modern, high-quality apartments for students and young professionals by project developer City Pads, who specialize in real estate makeovers. This accounts for the low vacancy rate, especially in business areas in Amsterdam and the Hague. (Bouwinvest.com. n.d. *The playing field for real estate investors in the Netherlands*). Some smaller cities needed to formulate new policies to prevent this complete transformation to residential properties, to retain the mixed-use character of city centers.

Offices in city centers and within walking distance of public transportation hubs have seen the most value growth in the past and will continue to do so in the future. In this context, the most modern buildings that pay attention to well-being, natural light, flexible space, and other unique needs are ideally positioned to benefit from this trend.

While all these pointers reinstate the importance of Commercial Office properties in the Dutch market, there needs to be an understanding of why this is the chosen domain for this research on Circularity. When you talk about a need to 'minimize the impact of a business on the environment', it is no longer a good-to-have, but more of a business essential. Employees, investors, customers and clients, the government, and the media are all increasing pressure on the business. According to the Leadership in Corporate

Sustainability – European Report 2018, three-quarters of European CEOs agree that ignoring sustainability would hurt their company's ability to generate long-term value (Oram, 2019).

Concerning Office spaces, the following reasons make it seem viable to adopt Circular Practices:

- Although office spaces are mostly in demand, there is always a risk of the property falling vacant. This can be due to change in requirements of the tenants, either in terms of a business change, or the way the organization works. To reduce the possibilities of high vacancy, the concept of flexible and adaptable spaces makes it more worthwhile to accommodate all types of requests.
- Commercial buildings, due to their nature of design and requirements, are a good option for experimentation with modular designs. Components used in modular structures can easily be dismantled to accommodate changing requirements. The concept of construction in layers allows us to distinguish between the flexibility, economic life, and usage of each.
- The Corporate Social Responsibility of commercial establishments obliges them to take up interventions that are beneficial to the environment. This provides hope that the stakeholders involved will be more aware of how they can provide adequate interventions, along with a willingness to accept and improvise innovative techniques.
- With the current situation of COVID-19 taking over the world, the 'work from home' culture has led to the temporary vacatur of various large tech parks and commercial establishments. This has caused a change in the way businesses are handled and dealt with, along with a need to think about how these vacant office spaces can be used. It would be interesting and necessary to see how the Circular Economy can play a role in addressing this.
- According to the Dutch government's new guidelines, office buildings must have at least an energy label C by January 1, 2023. If it does not meet this condition by that date, it can no longer be used as an office. This will encourage sustainable practices henceforth.

2.2.5 Reasons for loss of Value in Commercial Real Estate

Commercial Properties, like any other, undergo a loss in value over time, and it is interesting to consider reasons that they encounter a loss in value. Understanding this will further pave the way to deliberate how the circular economy can play a role in identifying and retaining property value for longer.

As per a Forbes article by Arshdeep Sethi, below is a list of reasons as to why there can be a loss of value in current real estate practices, re-emphasizing the need for Circular Interventions. (Sethi, A., 2021).

1;

2. Commercial leases usually forbid subletting space to other tenants; but, even if this were permitted, most tenants are concerned about security and are reluctant to share workspaces with other tenants outside of normal business hours. As a result, the room is underutilized for more than 12 hours per day.
3. Premature demolition, in which investment decisions are made based on opportunity cost and the asset's economic existence, is another cause of value dissipation. Building plans and legislation prohibit retrofits or other improvements to the house because current property spaces are designed for single-use occupancy.
4. The depreciation of products dissipates a great deal of value. Materials and components lose value more easily on paper than in practice due to normal business depreciation rates used for accounting purposes. Since most structures are not built for deconstruction, the cost of recycling materials is higher. Higher costs influence profitability, which in turn has an impact on resource and energy management systems, resulting in lower building efficiency.
   The cost of labor is more expensive than procuring new materials for construction. Hence, when given a choice between electing to renovate a property versus construct a new one, the finances are more favorable for the latter. This is perceived as a loss of value of a building that could have ideally been retained for longer.

2.2.6 Process of Valuation

A value can be assigned to any commodity. A valuation is the result of a process that determines its value. This can be rather simple in some cases. Most consumer products, for example, do not require an expert to determine their market value because they can be utilized right away and compared. In other situations, determining value necessitates a higher level of expertise and experience. When seeking to capture the value of a property, this is the case: no two buildings are exactly the same, and benefits from property ownership or interests are often realized over extended periods.

Even though valuations have become more sophisticated, and the underlying process has vastly improved in consistency and transparency, valuation purposes and methods have remained largely unchanged in recent decades; a valuer still typically provides a client with a single number, often an estimate of market value, or an opinion of value, which is provided under certain circumstances or scenarios, and is often a variation of the market value.

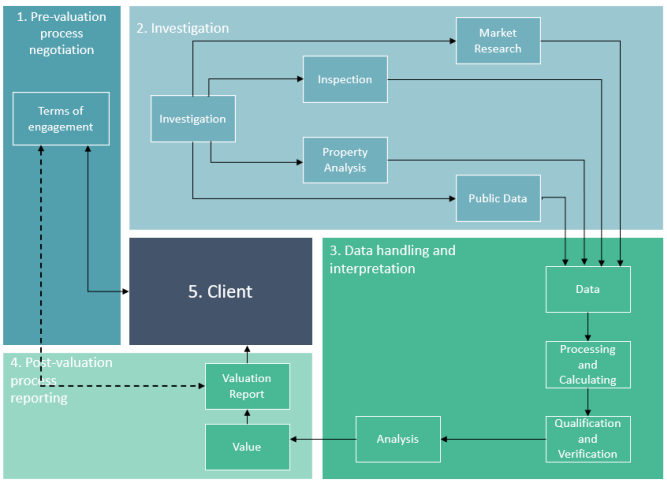


Figure 14: Valuation process; own figure; Adapted from Scheurwater, S. (2017). The Future of Valuations The relevance of real estate valuations for institutional investors and banks – views from a European expert group. Royal Institution of Chartered Surveyors (RICS).

The valuation process begins when a client asks one and ends when the value is determined and reported. Figure 15 depicts the many stages of the valuation process at a high level. Below is also an explanation of the entire process and what each stage entails.

2.2.6.1 Terms of Engagement

Before work on a project begins, a valuer and client are expected to discuss and agree upon certain conditions and additional details. Some of them include, the purpose of valuation and basis of value adopted, nature and extent of valuators work, any assumptions made, the valuation date, among others.

2.2.6.2 Investigation

A formal or systematic inspection or research on a property is referred to as an investigation. Investigations 'must always be carried out to the extent necessary to create a value that is professionally acceptable for its purpose,' according to the Red Book 2019. Below is a breakdown of each aspect of a property investigation.

Inspection	Property Analysis	Market Research	Public Database
• A property inspection can either be a full on-site inspection (internal and external) or • A drive-by external inspection • They are usually carried out using standard checklists	• Valuers usually specialize in certain asset types such as commercial, retail, residential or industrial • The valuer is responsible for verifying information and ensuring that they have the necessary experience to appropriately evaluate value	• A valuer must have extensive knowledge of the local market. This can happen on a local, national, or even international level. The location of a building is an essential factor in determining its value	• Public data is a valuable resource, which is easily available to everyone

Table 2: Investigation; own figure; Adapted from Scheurwater, S. (2017). The Future of Valuations The relevance of real estate valuations for institutional investors and banks – views from a European expert group. Royal Institution of Chartered Surveyors (RICS).

2.2.6.3 Data Handling and Interpretation

A key, but often difficult, element of the process is gathering the proper facts through investigation and from the customer. Often, barriers such as general market transparency, lack of systematic and centralized collection of building information and lack of quality assurance procedures causes problems in attaining accurate data. The main steps are described below:

Qualification and Verification	Processing and Calculating	Analyzing
• Identifying and defining which data is important, as well as ensuring that the data is of sufficient quality to be used.	• The 'number crunching' – converting raw data into meaningful valuation report outcomes.	• Interpreting the results and converting them into information that the client can understand.

Table 3: Data Handling; own figure; Adapted from Scheurwater, S. (2017). The Future of Valuations The relevance of real estate valuations for institutional investors and banks – views from a European expert group. Royal Institution of Chartered Surveyors (RICS).

2.2.6.4 Post Valuation Process Reporting

The most important outcome of the valuation process is a single value, which is stated in the valuation report. A valuation report is much more than just a number; it is the ultimate communication tool between the valuer and the customer. It gives clients impartial, comparative proof as well as written certification of a property's value. For this research, a detailed exploration of the valuation report is important. This is where a clear gap between 'what should be and what is the actual scenario' is visible. This will be explained in the subsequent section of the report.

2.2.7 Breakdown of a Valuation Report

As specified earlier, a valuation report expresses the value of the property. It provides a detailed breakdown of the property and site details, along with the parameters considered to value a property. The main themes are consistent throughout all reports, with slight variations from company to company. The primary difference would be the method of appraisal, which also demands different parameters for each type of real estate, as well as methodology. These will be elaborated upon in the subsequent section of the report.

The purpose of including this data here is twofold:

- To get a clear picture of the room for subjectivity in current valuation practices, which this thesis research aims to extract. Upon analysis of various reports, it is seen that the environmental section is still vague, and barely, if not none of the pointers discussed in it have a direct impact on the final value yet. This section of the report can be dependent on the interpretation of the valuator, which is why the research believes it to be subjective.

- The breakdown of a valuation report leads us to a list of factors that help determine the final value of a property. These factors will play a crucial role in establishing connections with Circular Economy principles.

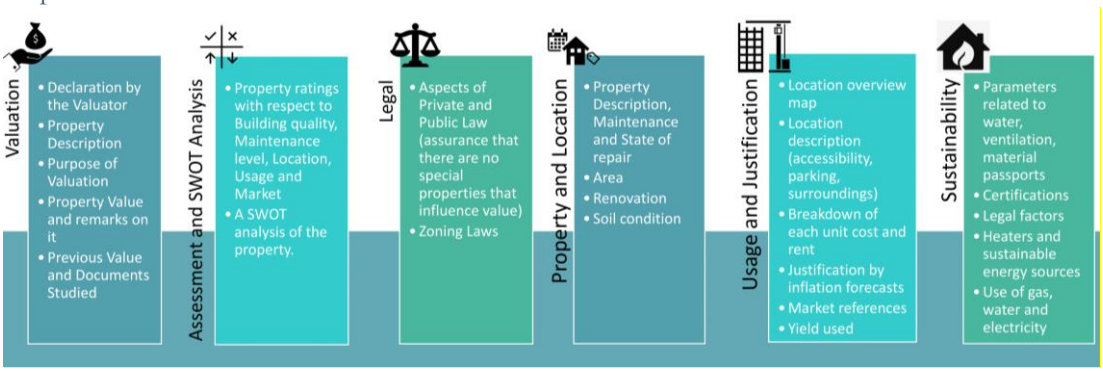


Figure 15: Components of a Valuation Report; own figure

We will elaborate only upon the sustainability aspect in this section, as it is crucial in identifying the limitation of the valuation report, that this thesis aims to address.

While often sustainable aspects are described in the report, they do not have a direct connection with the 'final value' of the property. This in most cases, is because there is no clear definition of a percentage increase of the value due to sustainability established. Often, if sustainability is seen to have a slightly higher value, it is primarily because of the market demand, and for stakeholders to be forerunners in the industry. There is a long way to go until investors and valuators see a clear-cut added benefit (in terms of financial value) from switching to sustainability.

2.2.8 Current Property Appraisal Methods

While there are various methods to value a property, four of them are predominantly used to value commercial properties. In most cases, these are used in combination with each other, and rarely used as an individual appraisal tool. Each of them will be discussed below. The parameters that help account for property value will then be extracted from them. Those will help determine the link with circularity within the existing methodologies.

2.2.8.1 Market Comparison Method

The market approach is a valuation strategy that considers the market values of similar assets or companies that have recently sold while determining the appraisal value of an intangible asset. Sales, book prices, and price-to-earnings ratios are commonly used price-related metrics (Corporate Finance Institute. n.d. *Market Approach - Methods, Uses, Advantages, and Disadvantages*). The approach is based on a like-with-like comparison. While properties can look similar, each one is distinct; no two will ever be identical. Comparables become less accurate as they step away from the ideal of absolute similarity (Shapiro, Mackmin, and Sams, n.d.).

The appraiser begins by selecting many identical properties from among all the recently sold properties. Since no two properties are alike, the appraiser must change the sale price of each comparable to account for variations between the subject and the comparable, such as height, age, construction standard, selling date, surrounding neighborhood, and so on. The appraiser derives the subject's current value from the comparables' modified purchase values (Pagourtzi, Elli & Assimakopoulos, Vassilis & Hatzichristos, Thomas & French, Nick., 2003). The availability, precision, completeness, and timeliness of sale transaction data are all important factors in the sales comparison approach. Government documents, data providers, and the appraiser's network of local contacts, such as brokers involved in transactions (Castle and Gilbert, 1998) are all useful in providing information.

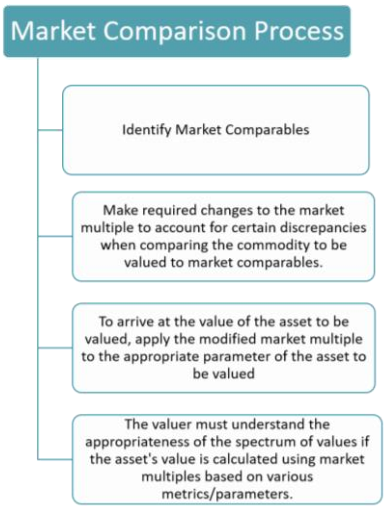


Figure 16: Process diagram of Market Comparison Analysis; own figure

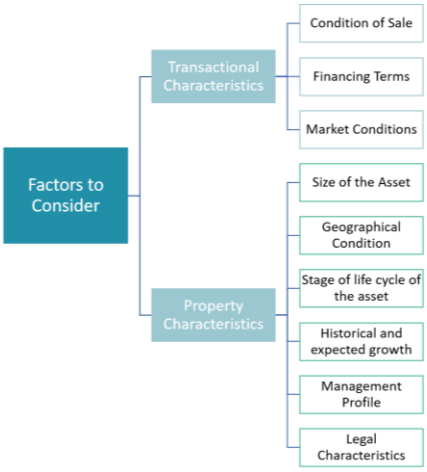


Figure 17: Drivers for Market Comparison Analysis; own figure

2.2.8.2 Income Approach

The income approach is a technique used by appraisers to determine the market value of a property based on its income. In finance, the income approach is a form of discounted cash flow analysis. The current value of a property under the income approach is the present value of the potential cash flows that the owner would hope to obtain. This method is most popular for commercial properties with tenants because it relies on rental income.

The direct capitalization method (DCM) and the yield capitalization method (YCM) are two strategies for capitalizing potential profits into a present value. The YCM incorporates profits over a multi-year holding period, while the DCM calculates value using a single year's income. Both will be elaborated on below.

2.2.8.2.1 Direct Capitalization Approach

The direct capitalization approach uses a single year's income projection to measure property value. The direct capitalization method is calculated by dividing the cumulative income by the respective capitalization rates calculated over the same time period. The cap rate is calculated by multiplying net operating income by the asset value.

Value = Net Operating Income (NOI) / Capitalization Rate

Because it is overly reliant on the property's income, the direct capitalization approach is not ideal for owner-occupied properties. The quotient value is dramatically reduced when the cap rate is raised. As a result, a lower cap rate indicates that the property's market worth has increased. As a result, the market value to be estimated is proportionate to the cap rate in an indirect manner ("Direct Capitalization Method - Overview, Appraisal Methods, Factors").

The net operating income, on the other hand, is proportional to the market value. The market value of a company rises dramatically when its net operating income (NOI) rises. A lower market value indicates a low NOI, which necessitates a strategic rise.

2.2.8.2.2 The Yield Capitalization Method

The yield capitalization method is a more complicated method of valuing a property. The net operating income estimates for a standard investment holding period are used in this process. As a result, the property value reflects potential projected adjustments in rental rates, vacancies, and operating costs. Over the holding era, yield capitalization does not require stable and unchanging market conditions. A forecast of the projected sales price at the end of the holding period is included in the yield capitalization process.

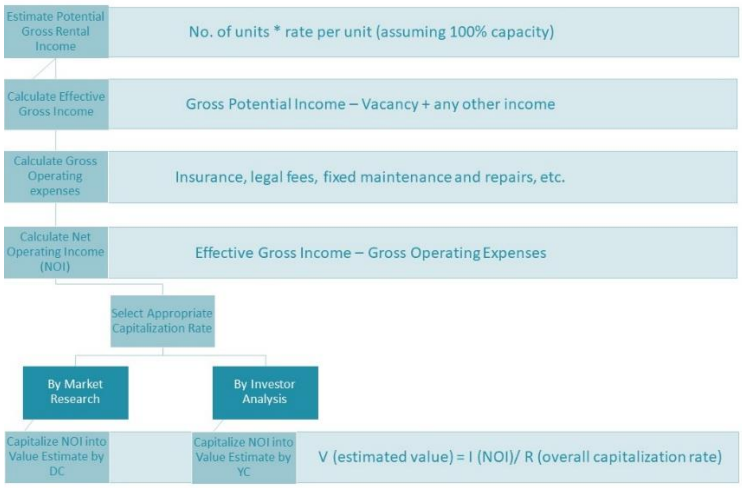


Figure 18: Process diagram of Income Approach; own figure

2.2.8.3 Cost Approach

The cost approach to valuing real estate properties is based on the premise that the cost of a property should be the same as the cost of constructing a similar property from the ground up. It has to be adjusted for the age of the property that we are valuating. The value of the underlying land, as well as the value of site improvements and constructions, are included in the cost of constructing a real estate property, less the depreciation cost of the improvements.

The cost solution is based on the idea that paying more for a property than it would cost to construct an equal property makes no sense. The contractor's valuation method is another name for the cost approach valuation method. The cost method to value investment property has three key components. Land value, building construction costs, and real estate depreciation are all factors to consider. The formula for the cost approach is as follows:

Property Value = Replacement/Reproduction Cost – Depreciation + Land Value

Since the cost approach is not focused on comparable assets or the property's potential to produce income, it assumes the cost of building a property today, considering that the current construction is to be demolished and replaced from the ground up. As a result, it considers the value of the land on which the property is constructed, less any reduction in value.

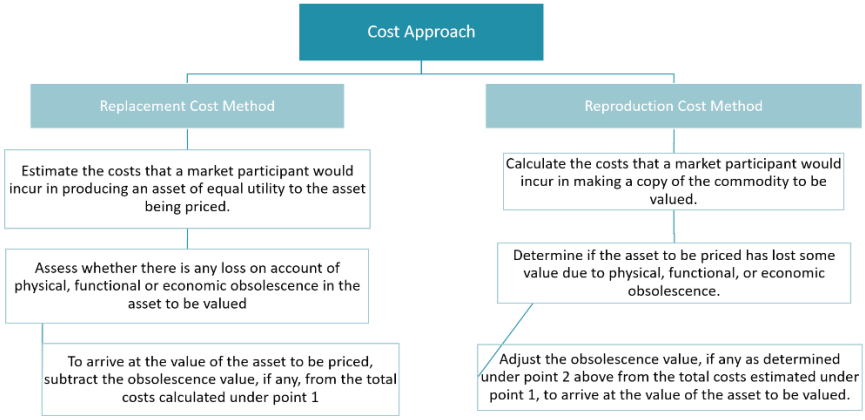


Figure 19: Process diagram of Cost Approach; own figure

2.2.8.4 Residual Value Approach

The residual approach calculates the amount left over after subtracting all known or predicted development costs from the project's expected value when finished, considering the project's risk (*Kupec, Josef & Dlask, Petr.,2020).* Changes in important inputs may have such an impact on a piece of land's residual value that competition may enhance its worth for reasons unrelated to its current use, and it is the valuation of these prospective development rights that is at issue (SAYCE, Sarah, et al.,2006).

2.2.8.4.1 Model of residual valuation

The residual method combines several standard valuation techniques. For commercial assets, a combination of income and cost approaches is used. When calculating the residual value, many valuation assumptions must be taken into account. The residual technique is based on a simple economic concept: the land's value is calculated as a surplus after all planned development expenditures have been subtracted from the predicted value of the completed development (WYATT, Peter,2007). To arrive at the residual value of the development property, deduct development expenditures and the developer's return from the completed "Gross Development Value." The residual technique is deduced from the equation:

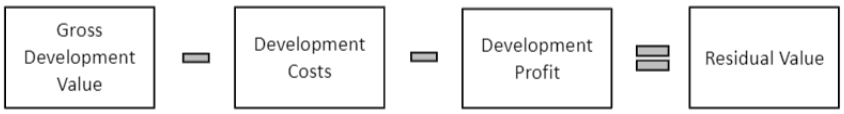


Figure 20: Equation for Residual Value Method

Gross Development Value: It is the estimated market value of a property or new development in the current economic context if it were to be sold on the open market.

Development Costs: The build costs element includes any costs related to the site preparation and construction of the property, along with the required fee to professionals, and legal consents and agreements.

Development Profit: The property developer must consider the required rate of return on their investment. For example, the price a developer spends for a development site in the starting place is closely tied to the amount of profit made at the end of the project.

2.2.9 Parameters of Valuation

Although each method of valuation seems rigid, with no room for maneuver and inclusion of new elements, the key to that lies in extracting each valuation parameter, since that is where scope for interventions and broader definition can be applied. The purpose of the research is not to suggest/alter the existing methods of valuations as they have a strong basis, but to broaden their scope of definition by selecting the right location to do so, which is via the parameters.

Every property valuation process is conducted based on certain parameters that are analyzed, which then leads to a final value for the property. These are the basis on which research is done, evidence is collected, and finally interpreted by valuators. This indicates that the entire process is not automated, but a significant weightage of a property value can be attributed to the characteristics and experience of a valuator. He is the middleman and the one who interprets the parameters to arrive at a value.

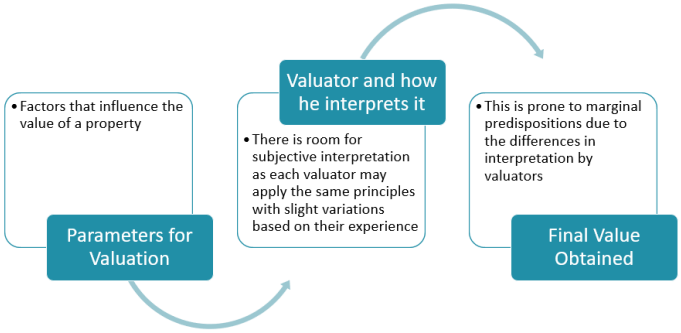


Figure 21: Role of Valuator; own figure

Certain parameters are accounted for in all types of appraisal methods, but they may differ based on the type of appraisal done, the purpose of the appraisal, and sometimes on the appraiser themselves. These are important to identify, as once there is an understanding of what drives the market value and on what basis is a property evaluation conducted, we will be able to find missing links or leeway to circular inclusions. Additionally, this would provide a basis for exploring where the obstacles and opportunities to circularity lie within these parameters. Further, via interviews, each stakeholder dwells into how they can impact or intervene within these parameters, to encourage consideration of circular dimensions in the final valuation process.

Hence, below, the parameters will be mentioned and elucidated upon.

1. *Demographics*
   Statistics such as age, types of households, average income level, and expected growth of a region and its population can help decide what types of properties are in demand, and thus how they will be priced. This data can aid in assessing the future expected lifestyle in that region, which will make it easier to assess what a person living/renting a space out there will be willing to pay for it. Thus, demographics have a strong relationship with the supply and demand of properties in a particular location as well.

2. *Historical and expected growth*
   The upward or downward trend of property prices over the last years is a valid indicator for future property values. As seen from previous collected data, property values tend to rise over time, but recession and other disasters can lead to lower value. Additionally, historical growth also has to do with the growth of the region and developments in its surroundings.

3. *Type and quality of construction*
   The quality of construction makes a significant impact on the value of a property. Damages, overdue repairs, and average quality materials used will bring down the value of the property.

4. *Bank interest rates*
   To purchase property, commercial real estate investors use leverage – or borrowed funds. The cost of credit is determined by interest rates. Credit is less expensive when interest rates are low. Because of increasing yields and growing property values, more money flows into capital improvements and commercial real estate. When interest rates rise, property values fall because of lower yields due to the increased cost of financing (Segal, 2019).

To explain this in detail, capitalization rates (cap rates) are applied to a property's first-year operating income to determine its worth. Cap rates and interest rates have historically been found to be significantly connected. As a result, it is reasonable to expect that, if all other variables remain constant, an increase in interest rates will raise cap rates, lowering property value. Furthermore, generally rising economic growth leads to increased demand for space and higher rents, which offsets interest rate increases. On the development side, higher interest rates raise the cost of construction and finance, resulting in fewer new products being developed. Rents might rise because of less available space flooding the market and consistent demand from tenants, boosting overall operational income if running expenses remain unchanged. These economic and market fundamentals are intended to counteract any property value declines caused by an interest rate increase.

5. *Purpose of Valuation*
   The aim of a valuation is crucial in determining the approach to take. When valuing a business for investment purposes, for example, the market approach may be inadequate and the income approach may be preferable (Shapiro, E., Mackmin, D. and Sams, G., n.d). A valuation can take place for various reasons, either an investment, taxation purposes, a rent function, a mortgage, etc. Each of them considers different parameters and hence their final value tends to vary. Many of these purposes, when studied and attempted to connect with circular principles, can include different business models of the CE. For example, if an insurance company requires a property valuation, we would address the parameters considered for them, along with factors that would depict lesser risk, to acquire an insurance policy. Quality construction, reusability aspects, or a product as a service model would be interesting reasons for insurance companies to cover premiums for the property (Shapiro, E., Mackmin, D. and Sams, G., n.d).

6. *Existing rent*
   The current rent forms the basis for an apt comparison in case a new tenant comes in. Some factors would have to be adjusted based on the economy, their individual contracts, type of company, among others, but having an existing rent is always a good comparable.

7. *Location and Neighborhood*
   It has been said many times that location is everything, and this is true in commercial real estate as well. At different times in the industry, different places would be more desirable. The usability of the location must be considered not only for the target market but also for future employees. It is crucial to double-check that the desired location is zoned appropriately for the type of company.
   Concerning the neighborhood, commercial value is said to influence household income when the commercial parcel is within a one-mile radius, according to Robert Cervero and Micheal Duncan (2002). When people remain near a commercial property, the value of the property rises because household income is high. As a result, when the household's purchasing power is high, they will be able to purchase the item. As a result, it is natural that the quality of the neighborhood would influence the rise in the value of the commercial real estate.

8. *Property Size*
   The rule of thumb in valuation with property size as a parameter is that the bigger the building, the lower the market rent per sqm/m^2 (with some exceptions). This is also the case for the building costs, when a property gets bigger, the building costs per m^2 will drop.

9. *Energy efficiency*
   Homeowners, enterprises, and utilities will all benefit from energy efficiency. Energy efficiency initiates that reduce energy consumption and maintenance costs will increase property value for building owners. Individuals and businesses are willing to pay a higher rent and/or a higher sales premium for energy-efficient properties, according to research (Eichholtz et al, 2011). The Australian Property Institute published a study summarizing the main results of six studies on green office buildings in the

United States, concluding that, although there was some variance between studies, average property prices were higher in green-certified buildings (Australian Property Institute, 2011). Investors are motivated to pursue deep energy retrofits by the prospect of higher property prices and other benefits, such as increased efficiency of commercial building occupants, as shown by research conducted for the IEA Demand Side Management TCP.

10. *Cost of Construction*

    The parameter cost has a direct relationship with determining the market value of a property. The cost approach to appraising real estate properties is frequently based on the notion that the cost of a property should be the same as the cost of constructing a similar property from the ground up. The value of the underlying land, as well as the value of site improvements and constructions, are included in the cost of creating a real estate property, less the depreciation cost of the improvements ("Cost Approach (Real Estate) - Overview, How to Calculate, Limitations; Investopedia"). Hence, lower costs of construction/replacement of building can lead to higher valuation.

11. *Income*

    The income that a building can generate is the prime basis on which a property market value can be arrived at. This is done via the income approach of valuation, which is a sort of real estate assessment method that allows investors to estimate a property's value based on the income it generates. When employing the income technique to buy a rental property, an investor evaluates the amount of income generated as well as other aspects to figure out how much the property could sell for in today's market. A lender will want to know the potential risk of payback if it extends a mortgage to the investor, in addition to analyzing whether the investor will earn from the rental property ("Income Approach (Real Estate) - Overview, How to Calculate, Limitations; Investopedia").

12. *Economic considerations*

    Real estate prices are influenced by changes in GDP, employment rates, products prices, and other economic variables (Nguyen, 2019). The current status of the economy has a direct impact on the demand for commercial real estate property. Higher demand will be created for the types of properties where specific products or services are offered, depending on where customers spend most of their money (Sagalyn, Lynne,1990). This contributes to the price increase. It also plays a role in determining the buying capacity of investors, at that moment.

13. *Rent-free periods/ vacancy rate*

    The vacancy rate measures the amount of time a property might be leased to the amount of time it was already rented and is calculated as a percentage (Chen and Anderson, 2020). Normally, vacancy is assessed over a one-year cycle. Vacancy rates are a key indicator of a rental market's strength, and they are affected by supply and demand. A market with a high vacancy rate, for example, might have an oversupply of rental units. As a result, investment risk is increased because properties could take longer to rent and market rents may be lower than anticipated. This has a direct impact on the final value of the property, as it is a prime financial parameter in the income approach of valuations.

14. *Time frame*

    Under normal circumstances, market transactions occur daily. Since the market is not static, the price received for a property at one time will not be the same later if the same property is sold. As a result, the validity of the proof of prices obtained deteriorates as time passes after the transaction. In a volatile economy, the proof becomes unreliable in a matter of seconds.

    The time frame can be looked at from different perspectives. There is the 'valuation date' (mostly the date the inspection of the property took place). This date is very important for the market approach since all the comparable references you are looking for took place as near as possible before the valuation date. However, the time frame used in the income approach is also a parameter often used (cash flow of 10 years or 20/30 years for example). Another way to look at the time frame is the time

needed to earn back extra investments (for example more expensive circular products), in which case time frame can be an important parameter for circular intervention.

15. *Age and Condition*
    One of the variables that influence the valuation of commercial property, according to Chris Huffman and Stanley D. Longhofer, is age. Both agreed that age had a negative impact on the valuation of commercial real estate. The regression yielded a positive age-square coefficient, indicating that as the age of commercial property increases, the value of the property decreases (Li Ping et al., 2019). When the property got older, the overall attractiveness and appearance of the property decreased, and the cost of repair and maintenance increased. Both factors would reduce demand for older commercial land, decreasing the value of such property.

    Another important aspect that can affect the sale or lease price of commercial real estate property is its physical condition. Properties in newer buildings will likely face fewer possible costs in the future in terms of renovations and improvements to new owners and tenants, thus significantly enhancing their market appeal (Nguyen, 2019). Older buildings, on the other hand, are more likely to need maintenance, some of which could be extremely expensive, lowering their desirability. The current state of the roof, the HVAC system, the age of the pipes and electrical wiring, the durability of the windows and doors, and the stabilization of the property are all factors to consider. Aesthetic enhancements, such as wood flooring in office spaces, stainless steel appliances in multifamily units, or immaculate landscaping on the exterior of the house, can have an impact depending on the type of property.

16. *Type of Investor*
    The mindset, approach, and vision of an investor play a significant role in the valuation of a property, along with the other factors mentioned. If an investor believes in the concept of the circular economy, he often pays higher than the calculated value, which compels valuators to think in that direction as well. Also, if they provide a strong case concerning why they believe a property is worth more, then the valuator has no choice but to evaluate it thoroughly, hold discussions, and then come up with a price. Valuation practices have a small portion of subjectivity, which can be utilized for instances like this.

17. *Stage of the lifecycle of the asset*
    If we want to design waste out of the building's life cycle as developers of a sustainable built environment, we must first understand the environmental impact of the various life-cycle stages. More influence is possible if we consider not just the use stage of a building during its design, but also the manufacture, construction, and end-of-service stages (Klein, Bilow, Sabbe, et al., n.d). The production stage, construction stage, use stage, and end-of-life stage are the four stages of a building's life cycle. The materials can either become an environmental burden or have a positive influence by being fed back into the production stage, minimizing raw material extraction.
    The value of a property also varies at each different stage of the lifecycle.

18. *Government policies / subsidies*
    Legislation can also have a substantial impact on property prices and demand. Tax credits, deductions, and subsidies are some of the ways the government might temporarily boost real estate demand while they are in place. They also have the power to make new changes in terms of regulations and standards. In this way, government policies either have a direct or indirect effect on real estate valuation. Knowing about current government incentives can help you recognize potentially deceptive trends and determine supply and demand shifts.

19. *Potential for Redevelopment*
    Commercial real estate's redevelopment potential can have a significant impact on its value. That is because a property's greatest and best use today may be very different from what it was when it was

built. Multifamily residential property, for example, is in high demand in many real estate markets (E. Kennedy, 2019). Redevelopment of warehouses into live-work spaces and outmoded shopping complexes into greater density residential housing are two examples of commercial property value improving because of redevelopment.

20. *Supply and Demand*
    The rule of supply and demand governs real estate prices. When there is a great demand for property but little supply, prices spike, and the market shifts to a seller's market. When the number of available properties increases, the market becomes glutted, and prices fall.
    A market study gives you the information you need to assess the availability and demand for specific types of real estate. Investors considering the purchase or development of office space, for example, value the property based on predicted future cash flows from rent. To anticipate future rental income, an investor or developer must first determine how much supply is available in the market and how demand will vary over time. The demand must be sufficient to maintain high occupancy and rental rates, ensuring that the return meets or surpasses the investment hurdle rate.

21. *Return vs Risk*
    The used capitalization rates are a fundamental aspect of valuation (in a way in every approach) and are also dependant on the current rents. Higher capitalization rates are expected by investors if they feel that the project is riskier than average. This can be due to the method of construction, materials used, or even due to the location of the project. The capitalization rate plays an important role in determining the value of a property.

22. *Depreciation Rate*
    Depreciation is defined as the expense of an asset that generates revenue throughout its useful life. Depreciation is the accounting term for allocating the cost of assets to the periods in which they are used ("Depreciation of Assets | Boundless Accounting", n.d.). Because the accumulated depreciation disclosed for each asset reduces its book value on the balance sheet, depreciation expense has an impact on the value of buildings. The cost of depreciation has an impact on net income as well. There are different methods of depreciation that are adopted based on the usage of the value. This rate is then accounted for in the calculating value of a property that depreciates every year and finally arrives at a residual value at the end of its lifespan.

These parameters have an impact on property value in different ways. Based on the interviews conducted as well as various brainstorm sessions with relevant stakeholders, they are further analyzed and subdivided as objective versus subjective factors. The meaning, as well as basis of this classification, has been elaborated upon in the *Results and Analysis* section. To decipher is circular principles can be incorporated in real estate valuation practices, it will be done by testing the shortlisted parameters against circular design strategies.

2.2.10 The Gap in Appraisal Methods and the potential link with Circularity

Currently, traditional office buildings are appraised using older, tested valuation methods. To demonstrate that the financial advantages of a sustainable building are maximized, investors must be able to equate sustainable building valuation appraisals to traditional building valuation appraisals to determine financial feasibility and make sound economic investment decisions.

Investors, owners, developers, and lending agencies depend on valuers' valuation reports to determine the asset's market value. The critical nature of financial decisions necessitates the use of a standardized framework for determining a property's market value.

The current market rents and yields of comparable properties are often used in determining market value, whether using the capitalization or DCF approaches. When determining market rents and yields for the

subject property, a valuer conducts a variety of comparative analyses of other properties. As a result, the property market climate has a significant impact on key determinants of market value. The valuation community, on the other hand, primarily relies on comparable transacted evidence to determine market rents and, as a result, market value. However, this strong reliance on comparable data has been widely criticized (Aldridge, 1989; Burton, 1992; Crosby, 1997), and the growing flaws in this reliance on comparable rents is a major issue when determining market rent for sustainable buildings. Furthermore, owing to the small number of sustainable buildings in the Netherlands, there is a dearth of data recording rent transactions. As a result, determining an acceptable market value for sustainable buildings is inherently challenging for valuers.

Subsequently, a valuer must determine other market variables to establish if the market data being used is suitable for comparison; some of these variables include stock levels and availability, vacancy levels, efficiency, landlord or tenant market, economic determinants, market pessimism, and tenant willingness to pay rental levels based on tenant requirements.

Lorenz (2007) concluded that the financial benefits of sustainable buildings should be factored into the property valuation process and that this could be determined by tracking gradual shifts in market participants' attitudes toward sustainable buildings (Jones Lang LaSalle, 2007).

The idea of a circular economy is one way to incorporate sustainability into the real estate sector in an organized way. According to Schoolderman et al (2014), a shift to a circular economy may have significant implications in a variety of areas of everyday life. This has an environmental effect because it involves a complete reduction in the use of fossil fuels and a complete reduction in waste production. Furthermore, by paying for usage rather than land ownership, an economic impact can be seen in the increased number of work openings.

When focused on Real Estate Valuation in particular, there is not much research done on the lines of inclusion of Circularity in that field. Until now, there has been progress only within construction, design, etc., where circularity has managed to play a role. As already discussed in the problem statement, there is a mismatch between the property values that are calculated and generated by valuers using traditional methods, versus the value of a property that would be arrived at if the value of circularity could be measured and included. The valuation profession appears to be largely unaware of research that suggests a connection between sustainability and market value, as well as the implications for valuation practice (Georgia Warren-Myers,2012). The research aims to bridge this gap.

2.2.11 Current Circular Interventions

Briefly discussed below are three valuation techniques adopted by various well renowned Real Estate companies, that have already included the concepts of circularity within their field of real estate valuation. These methods, as understood by the concept of the value hill, focus on the base of the hill. They aim to determine the minimum possible additional value that can be obtained if residual values of materials and other reusable components are considered. This here has been briefly elaborated only to provide a basis for comparison of the current value trying to be achieved versus the parameters we can aim at to attain a higher value of properties than what is currently being aimed for.

2.2.11.1 Wearthy Taxatie

This is one of the first circular valuation methods, that shows the value of raw materials as well as the materials in an existing building. It was developed by JLL, New Horizon, NIBE, and Grant Thorton.

It follows the idea that closing cycles are crucial to the circular economy. There are various materials and products in a building that have a longer lifespan as compared to the general economic lifespan of the building. In this case, it is responsible to value these items to know their worth, and then reuse/ recycle them as per the owners' wishes. This also makes owners aware of the financial value that will be lost if they demolish their building in a non-circular manner. As per the CEO of NIBE, the cost of raw materials today

does not include external environmental impacts of extraction, production, and processing. This thus undervalues the cost of raw materials. With the current pressure on the environment and climatic changes, he believes that it is vital to include the cost of these externalities in the base price of raw materials. This method of calculation is most prominently visible in the residual value of the building, towards the end of its life span. It is meant to impact the final resale value of the property.

2.2.11.2 Residual Value Calculator

Developed by TNO, this is a model of measurement that offers insights into the residual economic value of building materials, such as the interior and exterior façades of homes and offices. Often, we write off building components over the lifetime of homes and offices as ultimately having little to no worth. However, at the end of their usable existence, building elements, such as internal walls, also have a residual value that is greater than the return from the materials alone.

The goal here is to make any financial and material residual value transparent. As per the TNO website, the Residual Value Calculator tells users what their construction goods or the elements of their property portfolio are still worth at any given moment. The calculation model uses variables such as the price of raw materials, efficiency, detachability, and the cost of transport, maintenance, and repairs to measure the residual value after several years. Once the residual financial value of construction materials is evident to component manufacturers, project managers, housing firms, and project financiers, at the end of their economic lives, there would be an incentive to disassemble them rather than demolish them.

2.2.11.3 Renovalue

This is a project funded by the Intelligent Energy Europe Programme of the European Union, for two years. The project has built a training toolkit for property valuation practitioners on how to view energy conservation and green energy concerns in valuation practices, appreciate the effect of building performance and property values, and inform their customers accordingly (RenoValue Project, 2020).

It has been proven that with several property markets across the world, the prices of properties vary when they include 'sustainable elements' vs when they do not. This method of calculation is also most prominently visible in the residual value of the building, towards the end of its life span. It is meant to impact the final resale value of the property.

3. Stakeholder Analysis

To further strengthen the literature background, the research will also focus on the stakeholders in the industry, to see how they can play a role in the circular transition. Each of them has been interviewed, and this section introduces them.

Anyone that influences or is affected by the land development process is referred to as a stakeholder. Stakeholder analysis refers to a collection of techniques or methods used to define and comprehend the needs and desires of key stakeholders both within and outside the project environment (Smith, L. W.,2000).

In the Real Estate Industry, where collaboration is key, each stakeholders' views and perspectives are extremely important. Insight into the operating environment, the industry, patterns, user/customer needs, and growth opportunities, as well as a view of the organization's future, can all be gained through thorough consultation. Stakeholder needs are translated into organizational priorities through effective engagement, which serves as the foundation for effective strategy growth. Finding a point of agreement or mutual motivation aids a community of stakeholders in reaching a decision and guarantees an engagement in a worthwhile result.

According to Guy Grainger, EMEA CEO of JLL, there needs to be strong leadership to aid in prioritizing the Circular Economy as it is still nascent and challenging to implement. According to him, within real estate, there is much reliance on the supply chain of architects, engineers, developers, builders, along with furniture providers. Every connection must think laterally concerning new ways to design and operate buildings, which necessitates a paradigm shift (Lee, 2019).

3.1 Real Estate Valuator

This thesis will be addressed towards studying parameters of valuation and creating a guidebook for the valuator to see how circularity can have an impact on these parameters, and hence into valuation calculations. Therefore, the client of this report would be the valuator. It is vital to get an understanding of who they are, along with what they do and how they do it.

A valuator is an individual or a company that estimates the value of land along with the transaction values of buildings on it before it is mortgaged, sold, insured, taxed, or developed. He takes into account the current taxes, contracts, and developments for the particular property. He is ascribed with the task to deliver a valuation report that is used by both, the buyers, and sellers to establish the final sale price of that property (Bartke, Stephan, 2015). In practice, in a written survey or paper, the valuation specialist provides his contractor with advice on the fair market price of a piece of real estate, explaining in detail how the market value calculation was carried out.

Since they are mostly organized as a part of professional organizations, under all their professional, national, international, and local laws they are obliged to develop their reports as per the required international standards (IVSC 2013), and regional standards. In the Netherlands, the IVS and EVS (International and European Valuation Standards), respectively the 'Red Book' and 'Blue Book' are mostly used. Furthermore, there is the Nederlands Register Vastgoed Taxateurs (NRVT): this translates into the 'Dutch register of real estate appraisers' in which appraisers are registered and disciplinary law is practised.

A valuation is a generic approach that focuses on the objectivization of the main aspects of land quality. Appraisers should not give their viewpoint on value and must not, for the advantage of their contractor, manipulate business opportunities. They should instead include a well-founded, fair market value expert evaluation, including an assessment of current market risks.

Figure 22: Simple property market framework; Bartke, Stephan & Schwarze, Reimund. (2015). The economic role of valuers in real property markets - UFZ Discussion Papers 13/2015. 10.13140/RG.2.1.4318.5367.

3.1.1 Purpose of Valuation

The variety of purposes for which property valuation is needed has grown in tandem with the growth of the consumer economy and property market. It may be a product of a person's political, social, economic, or financial circumstances (Trojanek, 2010).

Typically, the valuation grounds originate from financial considerations that, to make reasonable decisions, require knowledge of the asset's value. The following are some of the most prevalent uses:

- M&A, inheritance transfers, judicial actions, company sale and purchase, company transfer, and business branch transfer, IPOs, and expropriation procedures are all examples of transfer reasons.
- Financing transactions, insurance values, tax compliance, statutory compliance, and compensation disputes are all strategic purposes.
- Economic feasibility study, purchase or leasing decisions and investment decisions are all part of the economic feasibility process.

3.1.2 Role of a valuer in the Circular context

If circularity characteristics are understood and recognized as influencing valuation, they should be integrated into the calculations to the degree that, a well-informed consumer and the economy will account for them, as shown by comparable transactions. Valuers should have the best qualitative evaluation based on the best quantitative data that should be relatively available.
When a valuer provides an investment value (often referred to as "worth"), elements that are not yet reflected in market value but could impact an investor's decision-making should be evaluated, and a determination made as to whether they are significant during the intended holding time. Similarly, whenever a fair value estimate departs from market value, it may be necessary to take in circular variables that are not yet evident in market transactions.
Valuers are urged to extend their fundamental collection of data to include a database of any aspects of the circular economy when collecting data on a property for valuation, even though they do not currently affect value. Valuers contribute to the advancement of expertise within the profession by developing an information basis on the sustainability of market comparable by extending the data available within the market, an important exercise in the valuation of new building properties (Ellison and Sayce, 2007).

3.2 Real Estate Developer

The RE developer is known as a firm's manager, responsible for managing a variety of players with varying objectives, and the factors of development are produced by teams. They create a business case to sell and realize the project. In sectors such as housing, office space, retail, and entertainment, real estate developers address critical needs such as providing infrastructure to support a rising economy. They play an important role in the real estate industry, bridging the gap between the building facility and the needs of the customer. They offer value in terms of design, expenditure, functionality, and location. Developers also market their properties and encourage a variety of industries to establish a presence there.

Usually, a developer is the one who conceptualizes the project. He is involved in the design and construction phase and is responsible for handling logistical issues arising with it. He hires various contractors and sub-contractors needed for the same. A developer hence is also responsible for handling finances in this period. It is only at a later stage of the project that he transfers rights to the investor of the project. He needs to assess all his costs, overheads along with a profit margin to then arrive at a selling price. Hence their relationship with a valuator is vital. Often, they retain their stake in the projects in case they see potential as well.

3.3 Real Estate Investors

An Investor is one of the key stakeholders in this industry. They are some of the primary people who aid in realizing a project. Depending on who the initiator of the project is, either a developer or the government, an investor receives a proposal after the project specifications have been finalized. He is not directly involved in the initial analysis and discussion of what is to be built.

Investors come in all shapes and sizes, but the 'financial firms,' which include insurance companies, pension funds, and investment trusts, are the primary investors in commercial real estate. Investors see real estate as a long-term investment asset, as opposed to banks, which aim to provide developers with short-term financing to cover the initial construction cycle.

An investor's reason for investing in real estate can be twofold: first, investors believe that market demand for space in the property would be sufficient to generate net profits after receiving rents and paying operating expenses. Second, buyers will sell assets after a period of owning them in the hopes of increasing their value over time. Additionally, there are tax advantages to investing in real estate. 2010 (Brueggeman & Fisher)

Real estate investors adapt their strategies to their specific goals and risk-reward trade-offs. To create profit, effective real estate investing necessitates the preservation of good money-management skills combined with local knowledge.

These stakeholders have certain primary expectations from projects, they include:

- Long-term return on real estate funds/mandates in line with a target return
- Financially stable business
- Market-based rental rates (Stakeholders' matrix | Bouwinvest 2017 - Real Estate Investment Management, 2017)

3.4 Banks

Banks are one of the primary stakeholders for Real Estate financing and Valuations. They are one of the first entities to go to when an investor requires funds to invest in a property. Banks first assess the project, conducts their valuation, assess the risks attached to that asset, and then determine the percentage or the

loan amount it agrees on financing. Interest rates may also vary for the type of property, and the risks involved with it.

A Valuation report provided by a bank varies and is lower than the actual market value. This is due to the following reasons:

1. Under normal circumstances, banks usually order an Automated Valuation Model (AVM) report, which contains a value arrived by observing past sales and current listings in the neighborhood. The AVM considers relative land values, the distance from the original property, along with the timeframe within which the previous property was sold. The AVM assesses its accuracy with a "Forecast Standard Deviation" and informs the lender how much to trust the value. These are the market values of the property.
2. Often, the value established by banks is lower than the market value. This is because they assess the property as a security for the loan. That is, if the borrower defaults on the loan, the banks have the authority to sell the property to recover the outstanding loan amount.
3. Additionally, a bank valuer will assess the value without any emotion attached. The property will be assessed in an 'as is' condition, hence if there are any minor states of disrepair or a low-quality presentation, that is factored into the report. On the contrary, a market value can often be driven by emotion, when the buyer has an exceptional liking towards the property, or there is a heated competition during the auction. In such cases, the value might end up being higher than predicted.

Now that the general process of valuation by the bank has been understood, it is important to dwell on how banks play a role in this circular transition within the Real Estate Valuation domain.
As per a report by the ING, the Circular Economy is a rising market that is expected to produce economic growth of 1 to 4 percent over 10 years. This accounts for the disruptive aspects of net growth that cause certain (linear) businesses to decrease or stop production.

Circularity is a sector that falls into the sustainability goals of many banks when certain businesses make the transition towards a Circular Economy. In the financial sector, the sustainability strategy has developed over time. Starting from mitigating environmental and social risks to encouraging, and eventually incorporating sustainable business into the core strategy (Bank, I. N. G.,2015), banks are gradually realizing the possibilities for sustainability. There is now data showing that sustainability-leading clients are more creative, show better financial results, and have better credit scores.

3.5 Architects

Various small and medium-sized architectural firms have begun researching, designing, and experimenting with various circular economy principles within the built environment. Due to this, the role that an architect must play within the chain of stakeholders expands beyond design and includes being a researcher, engineer, DIY builder, technologist a facilitator, project manager, etc. (TU Delft, 2020)

Architects are seen as an actor in the network who can persuade the client in implementing circular economy. Although they are not the main decision-makers, for them to be a part of the chain that aids in accounting for the unaccounted value in a property, architects need to be well versed with the different sustainable materials out there. A grip on understanding their cost, construction, and reusability aspect will help assign them end-of-life values. There are often issues with the lack of large-scale production of reusable construction materials.

Another issue that comes to notice is the organizational structure of the construction chain and problems in communication and collaboration between actors. Architects are hired on a project basis, which means that once a particular project is completed, their association with the client need not continue. In such cases, there is often no consideration of what happens to the building as well as materials used, post completion.

By considering the role and position of architects in this study, the aim is to decipher the issues they face, predominantly concerning considering values of materials they use, along with how they can contribute to guidelines for valuators.

3.6 Contractor

The function of the contractor, who collaborates with and affects the entire network, reflects its importance in the network. The contractor oversees the completion of the physical construction and influences network actors by their material knowledge. The understanding of the circular economy is influenced by the materials used. Contractors are said to have a lot of say in material selection, and they often pick and choose the materials themselves. This gives them a lot of power to make a difference, in stimulating reusability.

They can play a large role in extending the use phase of a building so that it has value for a longer period as compared to traditional valuation timelines.

Additionally, a contractor is capable of documenting and creating a database for all materials and components used in a project. This helps keep track of what can be reused or a material bank for the future. BIM models may also be created that can be used by the building control system, to integrate smart features.

It is often said that they are involved too late in the building process and should play a larger role in the project's collaboration. To enhance the implementation of the circular economy, the contractor emphasizes the importance of strengthening the network, cooperation, and information sharing between actors.

To assume these roles and responsibilities, the contractor must undertake a different role and deliver the building as a whole product. That is, to take up the responsibility of the design, construction, management, and maintenance. With substantial knowledge of the whole construction process, a contractor can implement adequate changes if he is the decision-maker for these aspects.

Once the role of each stakeholder has been analyzed, a summary of their interactions with each other can be derived. This aids in deciphering who could be the forerunners of transition to CE, within this industry. The figure below depicts the relationship between each stakeholder. As discussed in the Conclusion section, the Government was recognized to be a frontrunner to incorporate and initiate change in the industry.

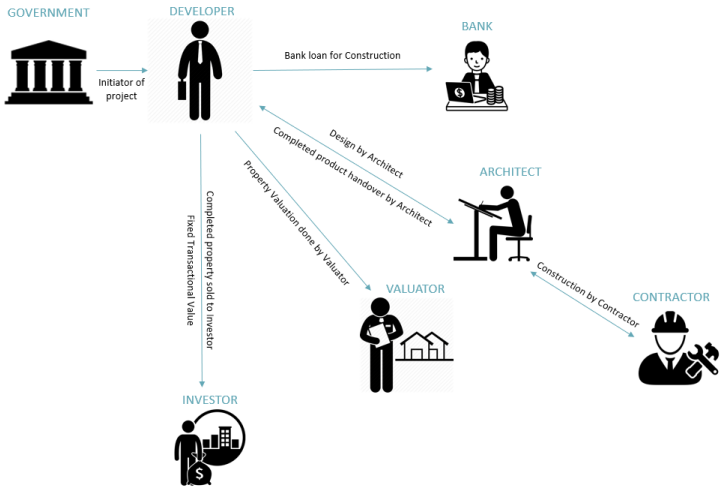


Figure 23: Mapping of Stakeholder Network

4. Methodology

4.1 Setting

With a strong base in the theoretical background and literature survey into the concepts that are needed to take the study forward, this chapter deals with the chosen research methodology to arrive at the outcome. While the previous chapter gave an overview of the base concepts of this thesis, this will focus on how we arrive at understanding the role and practices of relevant stakeholders, assessing parameters of valuation, and linking it back to circular principles, which then provides a guideline for valuators in preparing a 'circularity' friendly valuation report. Since majority of the information and inputs arrive from stakeholders, it was only apt to choose a method that would facilitate the same.

This chapter is divided into parts, wherein the first section elaborates on the research methodology used to conduct the study. The subsequent section reveals a method for gathering information from practitioners about their perspectives on circularity in buildings and valuation, the barriers they foresee, their position in this industry, and expressing how each of them can play a role in this inclusion. Finally, the next section discusses the interview protocol and analysis.

4.2 Process

As mentioned earlier in the report, not enough theoretical evidence and research has been conducted about the inclusion of Circular components in the Real Estate Valuation Process. Thus, the next best way to derive such information is via interviews with relevant members from this industry. The first step into this process would be to get a grasp of the valuation methodologies and parameters. For this, the opinions of stakeholders are important since there are most adept with the practical setting.

This research takes a qualitative approach, which entails gathering data in participants' settings, analyzing data in general themes, and eventually evaluating the significance of the data.

Hence, there are two parts to this explanation of the methodology used, one is the type of surveys and interviews conducted, and secondly, the technique followed to arrive at an outcome.

4.3 Research Method: Delphi Technique

The Delphi technique, named after the oracle Delphi, enlists the help of subject-matter experts (Sackman, 1975). The method aims to reach consensus among these experts through several rounds of interviews and questionnaires (Campbell & Cantrill et al., 2001, p. 7). The RAND Corporation designed the system in the 1950s and 1960s to efficiently gather and synthesize expert opinions. It is used for future decision-making, planning, and policy analysis (Gordon & Pease, 2006). The approach is often used in cases where there is a lack of consensus or significant ambiguity (Sourani & Sohail, 2015). Furthermore, Sourani and Sohail (2015) defined this as a method for obtaining information that is expensive or even inaccessible, for dealing with complex problems, and for combining fragmented knowledge from various insights to achieve a collective understanding.

4.3.1 Reasons for Application of the Delphi Method

Characteristics of Delphi Method	It focuses on ambiguity and uncertainty in a domain where knowledge is limited	The method does not demand precise answers of solid statistics	Taking the consensus of experts in the field, which is deemed as an	Delphi is used to gather opinions and thoughts regarding aspects of the future	It is used to explore consensus in an area relatively unknown

			agreeable second option		
Reasons for inclusion in this research	Although Circular Economy is fast spreading, the knowledge available can still be considered limited and broad.	Since this research includes interviews, answers are subjective and there is no one correct way.	A priority for the Circular Economy is collaboration, and this technique facilitates it.	These concern how the Circular Economy should be incorporated in Real Estate Valuations, which is the future.	Since Circular Economy is a new concept, a lot is still unknown.

Table 4: Reasons for applying the Delphi technique

Concerning the interviewees, an expert panel is selected based on their knowledge related to the relevant industry and the research question. This is because this approach was designed specifically for fields of study that are not well-known and therefore necessitate professional expertise for research (Sourani & Sohail, 2015).

When it comes to the Delphi sample size, there are no rules. According to Donohoe & Needham (2008, p. 480), a minimum of 7 to 15 respondents is needed. A larger panel size, on the other hand, may provide data that is significantly reduced in quality.

The number of rounds to be conducted in the methods varies between different researchers and the outcome they are looking for. The experts are presented with a questionnaire about the research subject during the first round of the research (Sourani & Sohail, 2015), and depending on how quick consensus is achieved, the rounds go on. Although some literature emphasizes the importance of using open-ended questions in the first round to recognize interesting, topical issues for the research, others include a list of issues based on literature for respondents to choose from or to inspire them.

These responses are then gathered and evaluated. In the second round, respondents are presented with a questionnaire that includes the newly collected information from the first survey about the groups' collective opinions. As a result, the experts polled are willing to rethink their first-round assessments. This iterative process continues for each expert until the desired outcome is achieved (Sourani & Sohail, 2015). The benefit is that instead of a quick agreement, a practical opinion is more likely to be reached. Furthermore, in the various rounds, this process is rendered self-evaluative (Sourani & Sohail, 2015; Yeung, Chan, & Chan, 2009). Most of the expert feedback required for this approach is gathered through the questionnaires.

When using the Delphi system, there are a few technical issues to remember. According to Donohoe & Needham (2008, p. 421), the Delphi approach has five drawbacks:

1. The Delphi method's design characteristics influence the outcomes.

2. Experts are expected to revise their opinions, but this is not a given.

3. The reliability of the results is influenced by high attrition rates (the pace at which respondents avoid contributing to the research).

4. Due to a lack of engagement or experience, the consensus moves towards the median.

5. It is difficult to know when to end the iterative process.

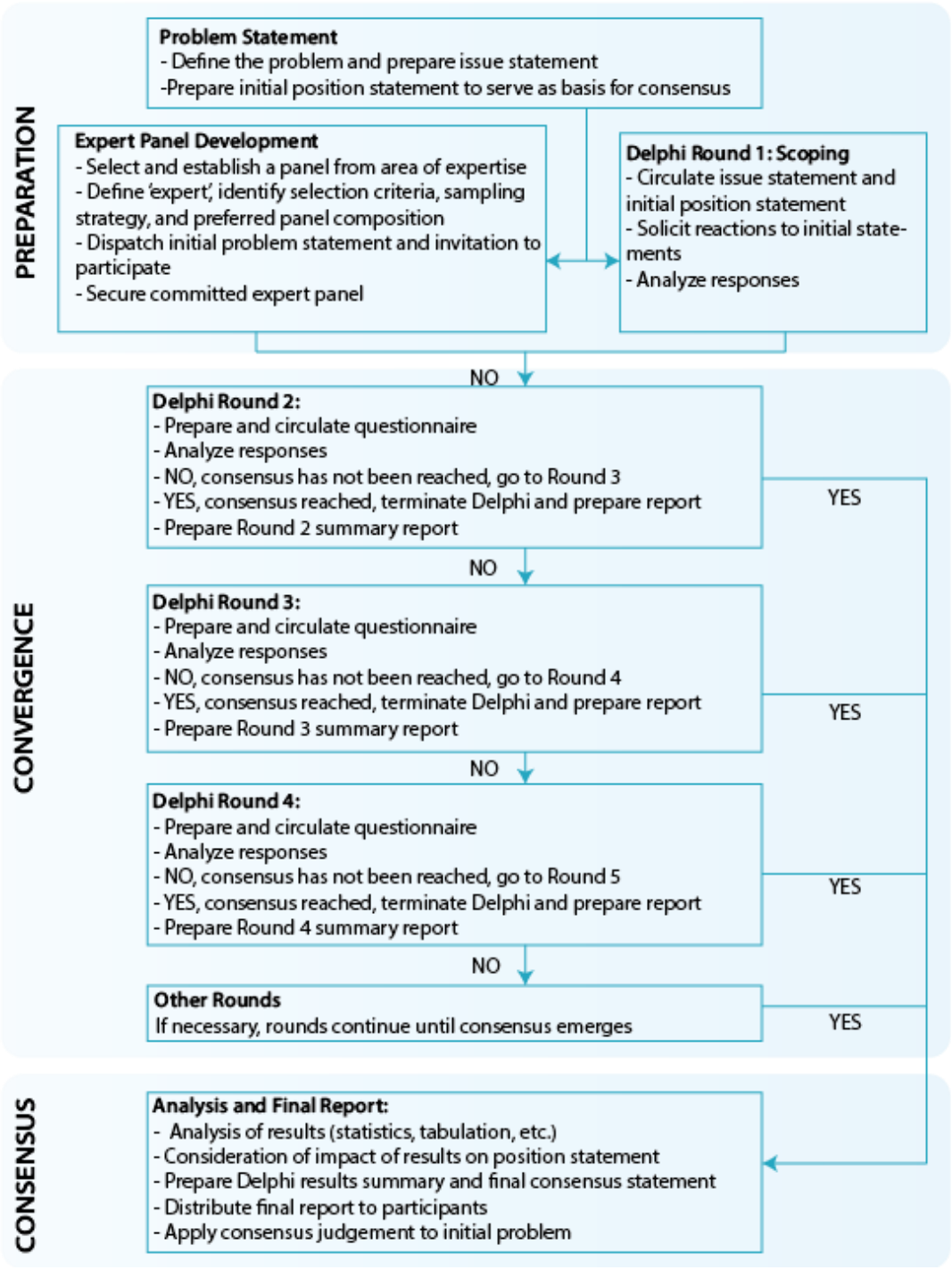


Figure 24: A Delphi study: general process adapted from (Donohoe & Needham, 2009, p. 426); own figure

4.3.2 The adaptive approach of the research

The Delphi technique has been adapted to fit into the framework and required outcome for this thesis. Concerning expert selections, only stakeholders that are involved in the Real Estate Industry and have knowledge about the Circular Economy are chosen. The second adaptation is the number of rounds conducted. For this research, two iterations of this technique take place, where the first is a curated set of semi-structured interviews for each stakeholder. These were conducted online via individual video calls. Each of them was asked a few general questions, followed by questions curated specifically for their field of profession. The data collected is analyzed and compiled to create the preliminary list of parameters as

discussed and validated by each stakeholder, along with an opinion about what part of their practices can entail circular interventions, within that list of parameters for valuation.

Upon analysis, a preliminary manual was created based on interview as well as literature findings. This manual, along with further survey questions is shared with them for round 2, which serves as a validation to understand if real estate valuators resonate with the hypothesis recommended. Hence, the purpose of using the Delphi technique, which is building on the previous round, along with arriving at a form of consensus, is adopted here.

Finally, a second round of validation is conducted amongst colleagues from Copper8, to confirm and arrive at an agreement about the definition and examples of Circular Principles used in the research. Here, thi final framework is then presented, post recommended amendments.

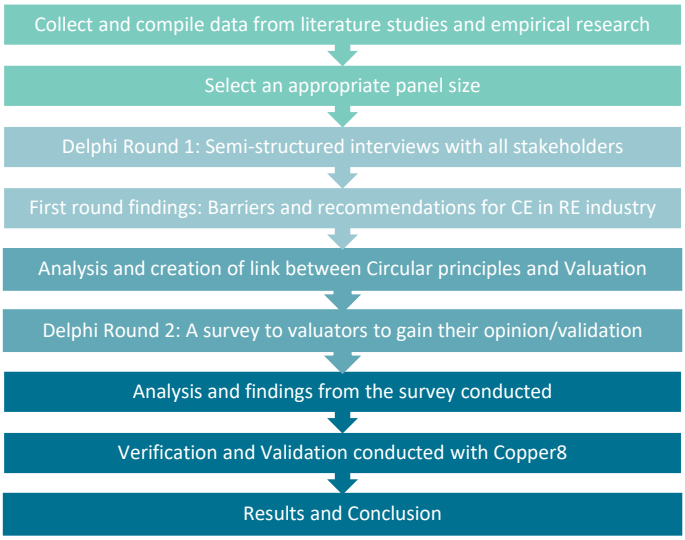


Figure 25: Process diagram of the Delphi Technique adopted

It is important to note that the nature of the Delphi Technique helped play a larger role in this research, apart from helping arrive at a consensus. This part has been discussed in the conclusion of the research, as it was identified during the course of the thesis research.

Since there were also certain drawbacks of this method, it is important to address them. The following technical issues raised by Donohoe & Needham (2009) are discussed during this study:

The Delphi method's design characteristics influence the outcomes.

The rounds are set up with a lot of consideration, and as a result, the approach is strategically set up to suit this study.

Experts are expected to revise their opinions, but this is not a given.

Since each respondent is likely new to the definition of CE and how to incorporate it into a contract, it is expected that the judgment and views of other experts can be seen as a valuable addition to their expertise.

The reliability of the results is influenced by high attrition rates (the pace at which respondents avoid contributing to the research).

High attrition is discouraged as often as possible by indicating to all respondents how much time is needed to participate at the start of the project, and by taking the lead in retrieving all relevant details. Furthermore, by speaking with each participant individually, a personal bond is created, which can encourage participants to participate.

Due to a lack of engagement or experience, the consensus moves towards the median.

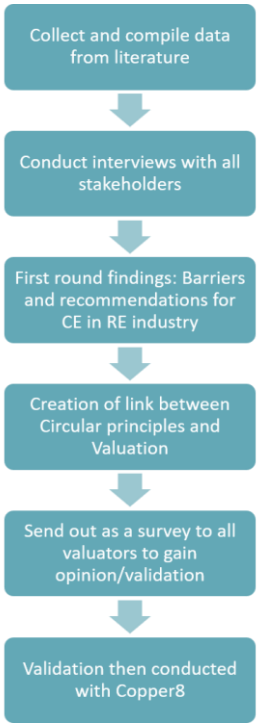
Point 2 discusses a lack of participation. By informing respondents that their lack of experience in CE is precisely why this study is needed, participants will become more motivated to participate.

It is difficult to know when to end the iterative process.

The decision to end the iterative process depends upon when the researcher believes that he has arrived at a consensus or based on what his opinion of consensus is.

4.4 Interview Methodology

As previously mentioned, the first-round interviews are conducted in the form of semi-structured interviews. This qualitative research approach was chosen to gather all relevant information during one-on-one personal meetings based on a pre-defined interview guide. In contrast to formal interviews, this approach allows the researcher more flexibility to ask follow-up questions that are not included in the interview guide but seem to be pertinent to the researcher (Cohen & Crabtree, 2006). This is crucial for this study because the amount of knowledge available about a circular real estate valuation method that is known at the time is limited. As a result, a less formal interview format should be used (Baarda, de Goede, & Teunissen, 2005).



The Delphi method's second round uses an online questionnaire. According to Singleton and Straits (2009), this method is appropriate for studying and describing human behavior. In the case of this thesis, it is apt as it helps probe into the mindset of the valuators, toward whom this round is addressed. Hence, after the first round of interviews, analysis, and initial findings are drawn, a report is made and based on that, the questionnaire is also created. It is addressed to property valuators in the Netherlands since this thesis aims to provide guidelines to them as an outcome. Hence, this survey also serves as a form of validation for the research analysis done, before a final round of validation is conducted among other professionals in the industry, such as Circular consultants with relevant backgrounds.

4.5 Interview Protocol

The approximate duration of the interview is about 40-45 minutes. The main aim of the interview is to find out:

- Whether stakeholders are aware of the circular economy and practices?
- What are the barriers and opportunities each of them sees in the CE domain?
- To what extent can their profession contribute to Circularity in Valuation?

In addition, attention will be paid such that the questions are as open as possible and not to steer the response of interviewees in a specific direction. Further, the interviews will follow an interview protocol to maintain consistency. The protocol (found in Appendix A) consists of three parts:

- The interview starts with an introduction of interview. Also, the other topics to be addressed are the following: Research objective; purpose, structure, and confidentiality of the interview.
- The content of the actual interview will again be divided into 4 categories: General; Circular economy; Real Estate Valuation and Circular interventions.
- Closing remarks

Due to the situation at the time of conducting these interviews, face-to-face interviews is not possible, therefore online video interviews are taken. The interviews will be transcribed from audio recordings.

Figure 26: Process of interviews conducted

4.6 Data Analysis

To begin the data analysis for Delphi Round 1, all interviews were transcribed using Atlas TI transcription software. The transcriptions were analysed once all the interviews were transcribed. To do so, the researcher first prepared codes for the various types of required outcomes. To make analysis easier, this was then divided into sub-zones. To identify barriers and opportunities perceived by stakeholders, for example, codes were generated for each, which helped to condense them and offer the frequency of each theme expressed by different stakeholders. The researcher did this without using any additional interview analysis software. The lack of additional software is because human interpretation is superior at determining whether a statement is connected to the issue. During the data analysis of an interview, it is usual to look for a comparable way of thinking among the participants. Different people, on the other hand, may have differing perspectives on project success. Because of these varying perspectives on project success, people may have different conceptions of the importance of circular economy in a project. This suggests that someone who gives a different answer than the majority does not necessarily have the wrong opinion or solution. Also, persons from other disciplines may have differing perspectives on the relevance of circularity and sustainability in a particular field of expertise or work.

For Delphi Round 2, a survey was conducted and results of it were calculated and analyzed using Microsoft Excel. Here too, although the results of the survey gave certain numerical values, they had to be analyzed and explained theoretically, by the researcher.

4.7 Research Criteria

There are a few requirements that the research must meet. Each condition will be described here. The research must be conducted in such a way that the criteria are met during the investigation. This will be revisited in the Discussions chapter to evaluate if the study fits these criteria.

4.7.1 Reliability

The research's credibility is a crucial factor to evaluate. This signifies that the data collection and measuring instruments utilized in the quantitative section of the study are trustworthy (Hernon & Schwartz, 2009). This means, according to Hernon & Schwartz (2009), that consistent data should be picked, as well as a measurement device that measures the same manner each time it is utilized. A consistent data set means that the same research results will be found with a different data sample from the population. For the qualitative portion of the study, dependability refers to the data's consistency (Hernon & Schwartz, 2009). The interviews will be taped to ensure that the results are as reliable as possible. This, according to Baarda (2017), raises reliability.

4.7.2 Reproducibility

The study should be replicable. This means that another researcher, or the same researcher, should be able to conduct the research similarly and achieve similar research results (Klumpers, 2018). All decisions and

steps taken during the research have been detailed in this final report to ensure that the research can be replicated.

4.7.3 Validity

A high level of validity should be adhered to in the research. There is a distinction between the research's internal and external validity. External validity means that the study should have a high degree of generalizability (Hernon & Schwartz, 2009). According to Hernon and Schwartz (2009), study findings should not only explain relationships inside the sample data set but should also be generalizable to the entire population. For this study, it means that the findings must apply not just to those working in the property valuation industry who took part in the study, but also to the rest of the valuation industry. It is assumed that by collecting the data from the case project the data set used for this research is as representative as possible for other valuation professions. The internal validity of the research asks, on the one hand, if the measurement instrument measures what it should measure and, on the other hand, if the researcher interprets the research findings correctly (Hernon & Schwartz, 2009).

5. Results and Analysis

This chapter presents the results of the interviews and surveys to gain insight into the best practices, challenges, and opportunities of circular interventions possible within the valuation process. This chapter is divided into two main parts. The first part is the first round of the Delphi technique (sections 5.1 and 5.2), which consists of semi-structured interviews with stakeholders from the industry and sets a basis for a strong analysis forward. All the experts have been in the industry for several years now and have strong opinions for sustainable and circular practices.

The findings of Delphi Round 1 are elaborated in two separate domains. The first one is concerning the categorization of parameters into factual and subjective, while the second is concerning outcomes and analysis of the findings from the interviews. Consequently, in section 5.3 a relationship is established between the circularity principles studied and the parameters of valuations extracted. This is important to enable the transition from abstract concepts to practical applications in the industry. In section 5.4, Delphi Round 2 is elaborated upon, where the questionnaire circulated amongst valuators to validate the analysis is discussed, for whether they would be open to such interventions within their existing parameters and framework. The results of that are elucidated upon. Finally, section 5.5 details the insights and conclusions from the validation session to arrive at the final validated framework.

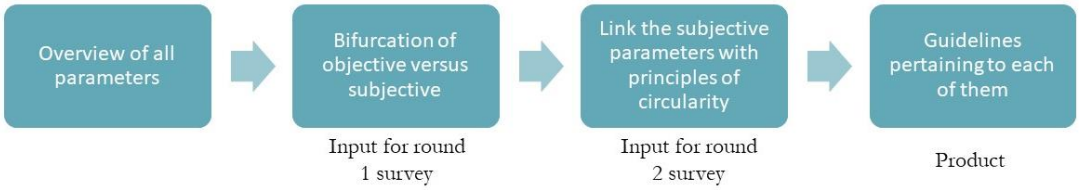


Figure 27: Framework for arriving at the final product

5.1 Categorization of Parameters of Valuation

As already discussed in the *theory for real estate valuation,* 22 parameters were identified, based on which properties are valuated. Each of these was extracted from the four methods of valuation discussed, and are often used interchangeably with the different approaches, based on various external factors as well. Here, as a finding from the initial interview/ brainstorm session with stakeholders, the further subcategorization as 'factual' and 'subjective' parameters emerged. The primary basis for this division is whether they can be impacted by external interventions and deliberations or not. As per one of the interviewees, "***Each property valuation is predominantly objective, but there is a small portion that is subjective, based on the individual valuator, and within this small room, there is potential to tap at circular values***". Centered on this statement as well as validation by other stakeholders, these parameters are divided as the following.

Property (factual)	Location (factual)	Calculation/ financial parameters (subjective)	Key drivers (subjective)
Age and Condition	Demographics	Interest rates	Type of investor
Size	Historical and expected growth	Costs	Supply and demand
Ease of property transfer abilities	Local neighborhood	Income/existing rent	Govt. policies
Construction style		Vacancy rate	Stage of lifecycle of the asset
Legal restrictions (zoning laws)		Depreciation rate	Energy labels
		Time frame	

Parameters for Valuation

Potential for Circular Interventions

No direct effect on Circularity

Table 5: Parameters for Valuation

The parameters highlighted in grey are 'fact-based' parameters, which means that there is not much scope of interventions within those. They are based on standardized descriptions such as the age of the property, location, etc., which are their sole driving forces for prescribing a value to them. The highlighted parameters in green have been identified as having room for subjectivity, even in terms of interpretation by valuators. Each of those can be impacted by several external influences, and that is where the potential for circular interventions also lies. Further in the research, only the parameters highlighted in green would be taken forward to establish connections with circular strategies, as they have maximum scope for broader interpretations. They are detailed out below in terms of how each of them would be analyzed. As shown in Table 6 below, the calculation parameters can be linked directly with circular principles, and each of those are validated by real estate valuators from the industry, to understand if such measures can be feasible in their calculations. The right usage of circular principles is also validated by Circular consultants from Copper8, to make the case stronger.

The second half of the list, which consists of key drivers, has maximum information output from literature as well as the interviews conducted. They are elucidated upon in the form of barriers and opportunities for circularity. The analysis of this list and discussions with stakeholders aided in creating the primary link of circular principles with financial parameters.

Link with Circular Principles by own Analysis	Link with Circular Principles via interviewees
Calculation/ financial parameters (subjective)	**Key drivers (subjective)**
Interest rates	Type of investor
Costs	Supply and demand
Income/existing rent	Govt. policies
Vacancy rate	Stage of lifecycle of the asset
Depreciation rate	Energy labels
Time frame	

Table 6: Analysis of valuation parameters

5.2 Major Insights from Interviews

This section of the report tries to answer sub-research Q3 of the thesis. Delphi Round 1 consisted of in-depth, semi-structured interviews with eminent stakeholders from the industry. Each of them had interesting perspectives about the current scenario in the industry, as well as their take on the potential for a circular economy in the upcoming years. From all the interviews conducted, the two most prominent outcomes were opportunities for sustainability/circularity as well as barriers currently faced for the advancement towards circular strategies in projects and their valuation. The highlights and primary insights of these will be summarized below, and the detailed version of all the findings from the interviews will be found in *Appendix C*. The barriers are further divided into subcategories, based on the theme they discuss. Below is a list of interviewees, for reference.

Sl. No.	Type of Stakeholder	Organization	Location
1.	Circular Consultant	Circular Consultancy	Netherlands
2.	Real Estate Valuator	Valuation Company	Netherlands
3.	Real Estate Developer	Construction Company	Netherlands
4.	Real Estate Valuator	Construction and Real Estate Company	Netherlands
5.	Real Estate Developer	Construction and Developers	Netherlands
6.	Real Estate Developer	Construction and Developers	Netherlands

Table 7: List of Interviewees

5.2.1 Barriers

5.2.1.1 Legislative Barriers

The Interviewees were asked if they saw any legislative rules or regulations as barriers as the reason why there is no form of circular valuation yet. They were also asked the converse, if they did come across any regulations that encouraged the inclusion of circular principles to eventually account for a value. Some of the discussions and pointers are reviewed below.

One issue that stood out is the concept of a Product-as-a-service model. Even though it is an element of Circular Economy, according to stakeholders, certain regulations need to be established for it to function practically. According to Interviewee 5, a developer, leases are accounted as additional costs by the company, which does not help incentivize this concept to them. Hence, even though they apply certain circular principles in their projects, this model is avoided.

As per interviewee 4 who is a valuator, "If in a circular building there are components that have been leased out, and ***not owned*** by the developer/ investor, which must also be returned at the end of the lifecycle, then as a valuator when you look at a leased item, ***you account for it as added costs for the project, and not an added value or an asset for a building***." This defeats the financial purpose of not buying the product. Appropriate regulations need to be curated for the Product-as-a -service model.

Additionally, "due to future ***legislations by the government***, every project will eventually require sustainable components in their design and usage. The usage of ***sustainable materials will become obligatory*** and standard. Will it then have extra value or merely a new standard value?"

Here, there is a high level of contemplation whether mandatory sustainability will bring about a higher value in properties, or the new value eventually obtained will become the new standard for buildings and the crux of higher/lower value diminishes down the decades.

5.2.1.2 Financial Barriers

As per interviewee 4, when you have reusable building materials, the exit value is negligent in comparison to the cash flows. An investor requires a return on investment, and they will try to re-lend the property for as long as they find new tenants. If they find a new tenant for 10 additional years beyond the stipulated lifetime, who pays half the rent, the building will still be leased out, instead of being demolished because its economic life is over. The additional harvest then received after the extra 10 years is still unclear. Hence here the dilemma is, should you use the building for 10 additional years, or harvest it when the 'economic lifetime' is over, to gain value from the demolished building.

"There is probably a very ***small profit*** that can be attained with circular interventions currently, but there is ***no effect on cash flows during exploration for the current investor***. For an investment of millions, they probably got 2000-3000 for the materials, which is insignificant."

Additionally, as per interviewee 1, a valuator by profession, the current period of a DCF for valuation of properties is usually 15 years, which is a bare minimum. It is not enough to see the benefits of being a flexible property since usually, a tenant retains usage for the property for that amount of time. Hence, it does not make an impact if the property is flexible as benefits of it are not seen within 15 years. They also do not consider using a longer timeline due to higher risks for the client.

5.2.1.3 Technical Barriers

To be able to include circular components within the existing methods of valuation, circular and sustainable components that are already constructed must be able to prove that they are truly circular and there are possibilities to use and reuse them in different forms, while retaining/maximizing value. There is no proof yet. This was a major concern by Interviewee 6, who is a developer and has faced such issues with trying to incorporate bio-based materials in her projects (as tar for the renovation of roads). They were rejected due to a lack of proof for longevity. She believed that to allow for such changes, the government should be more accepting of new materials and include them in their permissible database.

Additionally, as per interviewee 4, as stated below, he does not believe that including subsidies by the government would provide the true value for the product. It would drive the demand higher, but only temporarily. There is no proof of higher demand in the market otherwise, which would lead to wrong valuations. He substantiated this with an example of a solar panel, whose true market value is still unknown due to the high demand but is mainly in demand because of subsidized rates.

"***Subsidies*** from the government can be ***misleading***. Probably then the reason for the demand of a particular asset is due to the subsidy, and this ***does not reflect the actual market value***/demand for it."

5.2.1.4 Organizational Barriers

For flexibility in the portability of buildings, there are a few key issues that have been highlighted by interviewee 3.

- The second location of the movable building is undefined at the beginning of the project. For an investor this is a risk, and he would feel the need to earn back all his investment in the first phase/location of the project, even though its lifetime could be way longer.
- There is a possibility that the value of the building in the first location goes down to zero once it has been shifted, due to a change in legislation. This is a risk the investor would be apprehensive to take.

- If a property lifespan has been defined for a shorter period (say 15 years), its value is already deemed to be lower in the first set of calculations. Also, there is not enough clarity for what to do with the remaining materials after 15 years.

Here, clearer organization as well as regulations, need to be set for what happens to properties when they can be moved from one location to another. The principle of adaptability cannot be addressed on its own, because in property valuation, location plays the most important role.

"The ***willingness of valuators*** to look more in the future along with past comparables as well is one of the ***largest challenges***. Once that mindset evolves, the transition will be smoother."

A very strong but relevant observation was made by interviewee 2, a valuator himself, who identified this formidable barrier within his industry. He notices the lack of motivation to be the changemakers and would like to change that with the help of workshops and training sessions for valuators in the company. This is also one of the primary challenges this research aims to address, by providing valuators with a set of recommendations and a manual, within the circularity domain.

5.2.2 Opportunities

The stakeholders also identified certain opportunities and further recommendations concerning their fields and opinions about the inclusion of sustainability in valuation calculations. These are discussed below.

To start with, there is a transition in valuation practices where clients now want elaborate reports on the parameters considered. If valuators encourage detailed discussions for each, it will enable investors to reason out why they believe sustainability has a higher value, and this would encourage valuators to think in the same direction as well.

"There is probably ***more value for a developer to 'harvest'*** a property instead of demolishing it, to ***lower his demolition costs***, rather than expecting users/investors to pay the premium for circularity as they will not see direct benefits."

This statement above was made by an investor, who felt that there are more advantages if the developer reuses materials in his redevelopments. Interviewee 5, a developer also reiterated that this is exactly what they as a company do for all their redevelopment projects, as it has cost savings for them as well.

Concerning the rule to have a mandatory energy rating label as C or above, various commercial establishments will have to be refurbished to be eligible to function. This brings incentive to modularize them and focus on making buildings more adaptable, to avoid losing out on potential tenants due to further renovations and adaptations, losing out on time. Stakeholders believe this to be a good opportunity for them to make their place in futureproof buildings.

Additionally, if the stipulated Carbon Dioxide taxes are implemented on building materials and construction practices, then circular buildings will have an advantage and pay lesser taxes than non-circular/sustainable buildings because of reduced emissions by their practice. A recommendation would be to tax this annually rather than as a one-time fee because if it is a one-time initial fee, it will be deducted from the residual value and then most likely the municipality will have to pay for it.

"Government can assess if circular buildings can pay a ***lower transfer tax*** while transferring property to other buyers. This can prove as a ***financial incentive*** for builders. Currently, the parameters for assessing this tax do not include sustainable outlooks."

Future scarcity of materials and their rising prices can be a stimulant for sustainability in long-term development projects. In those cases, it would be wiser for developers to already think of the consequences of the shortage of raw materials and start thinking of alternatives for the same. Whether the costs eventually increase or not, they would be paying a premium for mitigating the risk, which is a fair trade for them.

5.3 The link between Valuation parameters and Circular Principles

Upon assessing the barriers and opportunities as seen by real estate stakeholders, it is apparent that all of them believe there is scope for circularity, which will lead to assessing its impact on the transactional value of the building, although it has a long way to go. The discussions held with interviewees aided in substantiating possible scenarios as well as certain disadvantages of the circular economy, that would invariably reflect in the valuation as well, upon implementation.

The first step to establishing a connection between the two themes (CE and RE Valuations) is to understand some examples of scenarios in the practical world where the circular principles are applicable. This is predominantly for valuators to strike a connection and recognize circular design strategies when they see it in a building since it is not directly their area of expertise. Each principle, along with examples, has been explained in the *Theoretical background, Principles of Circularity*.

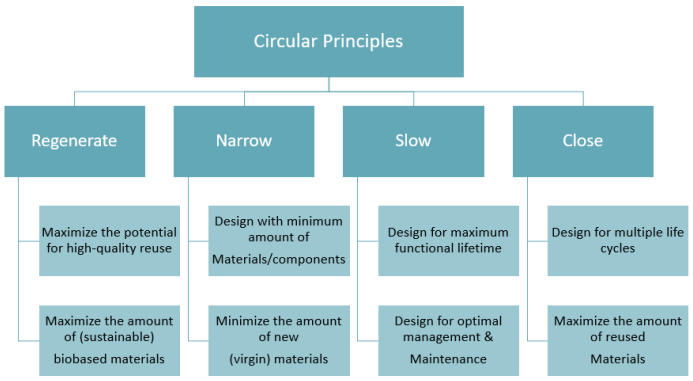


Figure 28: Circular Principles

Once these have been established and familiarized with, the link of valuation parameters with circular design decisions will be seen clearer upon explanation. A 'check-list' of circular design parameters makes it easy for valuators to first be aware, and then take decisions on which parameter might be impacted due to the interventions.

As explained above in section 5.1, *Categorization of Parameters*, there are six primary calculation parameters for valuation that have the potential to be linked with circular principles. These are the parameters that require numerical inputs, but their reasoning is open to interpretation and subjectivity. An in-depth analysis was conducted after the interviewees, to arrive at plausible influences of each circular principle, on valuation parameters, and each of them have been elaborated on below.

5.3.1 Circular Principle 1: Maximize the amount of Sustainable (Bio-based) Materials

While the definition, description as well as examples of this have been elaborated on in the theoretical background of *Circular building principles*, the implication on valuation parameters will be discussed below.

Biobased materials are materials that grow in nature, such as hemp and wood. In theory, these materials can be used endlessly. Additionally, during their growth process, they take up CO_2 from the air leading to a low carbon footprint. It has an implication on 'interest rate', 'cost', 'income', and 'time frame' parameters.

- Interest Rate and Income: By upscaling usage of sustainable materials in construction projects, there is a direct impact on the savings due to impact/green loans (lower interest rates) levied by banks, for sustainable construction. A lower interest rate leads to overall lower construction costs in the cash

flows, allowing for higher profits and income obtained by developers, provided the other aspects are the same. Higher profit can lead to higher income and thus potential for high market value.

(+) Lower interest rates = (+) higher savings and profit

(+) Higher profits = (+) scope/potential for higher market value

- Cost: On the other hand, it should be known that there is a possibility of higher initial costs for developers since sustainable materials are not produced in the market in bulk yet and buying them in small quantities turn out more expensive than high usage non-renewable materials. It then may be the case where higher costs can lead to lower market value determined, although currently, there is no direct implication, but potential to explore further in that area.

(-) Higher investment costs = (-) potential for lower market value

- Time Frame: Because sustainable materials are more expensive currently, it will take a longer duration to earn back higher investments as compared to cash flows predicted for non-sustainable materials, making it riskier to invest.

(-) Longer recovery period = (-) higher risk

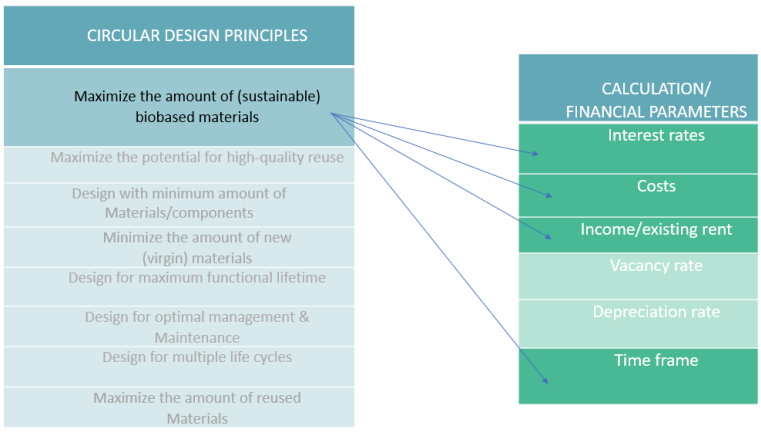


Figure 29: Association between Circular Principle 1 and Valuation Parameters

5.3.2 Circular Principle 2: Maximize the potential for High Quality Reuse

While the definition, description as well as examples of this have been elaborated on in the theoretical background of *Circular building principles*, the implication on valuation parameters will be discussed below.

When materials are reused, it is important that they are safe for it. When solely focussing on reusing materials, there is risk of reusing toxic materials, while you would rather not reuse them at all. It has an implication on 'vacancy rate' and 'income' parameters.

- Income: The most important aspect of maximizing the potential for high quality reuse of materials is to ensure a minimum amount of toxic and hazardous materials are being used. The 'cleaner' the materials are, the higher the potential for high quality reuse there is, resulting in a higher residual value, thus in a higher market value.

(+) Higher residual value = (+) higher market value

An indirect effect of this principle could be that 'healthy' buildings will be created. Healthy buildings have proved to lower the sickness of employees and increase productivity. This could have potential for increasing the rent of these healthy buildings, thus resulting in a higher market value.

(+) Higher income = (+) higher market value

- Vacancy Rate: There is potential for increased productivity to translate to having satisfied tenants, who would prefer to stay long-term, and various businesses being attracted to the property creating a high demand. This would translate to a lower vacancy rate, resulting in potentially higher market values.

(+) Lower vacancy rate = (+) higher income = (+) higher market value

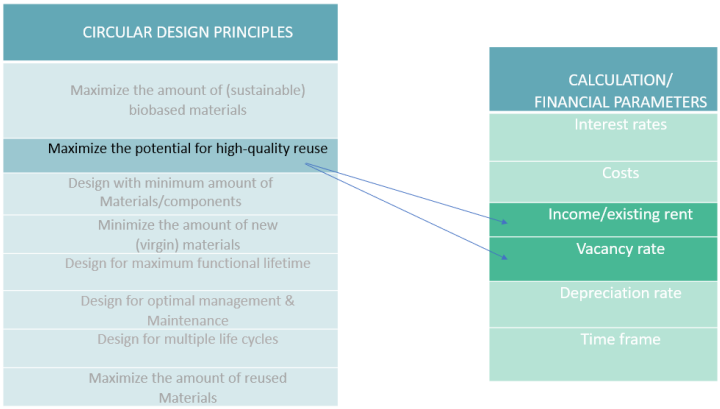


Figure 30: Association between Circular Principle 2 and Valuation Parameters

5.3.3 Circular Principle 3: Design with Minimum amount of Materials/Components

The definition, description as well as examples of this have been elaborated on in the theoretical background of *Circular building principles*. The implication on valuation parameters though, will be discussed below.

In this case, the only direct implication will be on 'cost'.

- Less material consumption implies lower costs for purchasing, which can lead to higher savings and thus higher profits. In this case, the total amount of materials used is minimized, leading to lower building costs. Ideally, here, there should be potential for a higher market value of the building because of higher profits. But it must be noted that higher profits for the developer might not always translate as higher income for the property owner. The developer might attain a higher transaction value when selling to the investor, but this need not translate into a different market value. There is scope for valuators to decipher this more accurately in the future.
  On the contrary though, if this savings in cost translated into higher rental income generated, or lower operational costs, then it is a valid direct parameter of the cost approach of valuation. It means that with lower costs, and other attributes remaining the same, the market value would be higher. That will be depicted in other scenarios ahead.

(+) Lower investment costs, while benefits stay the same = (+) higher profits = (+) scope/potential for higher market value

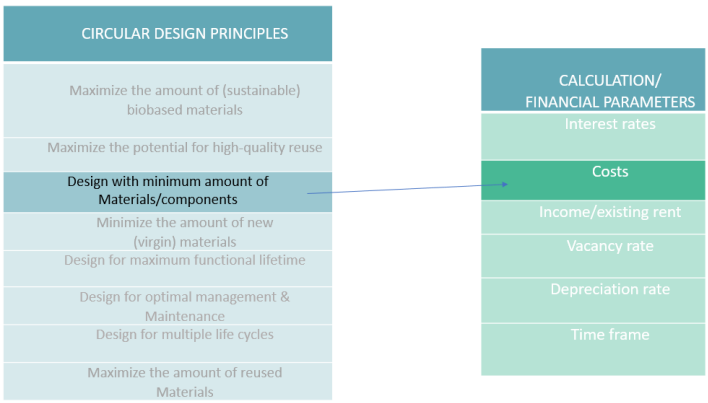


Figure 31: Association between Circular Principle 3 and Valuation Parameters

5.3.4 Circular Principle 4: Minimize the amount of New(virgin) Materials

While the definition, description as well as examples of this have been elaborated on in the theoretical background of *Circular building principles*, the implication on valuation parameters will be discussed below.

The central goal of circularity is to minimize, and eventually stop the use of virgin materials, as they are not infinite. It has an implication on the 'cost' parameter.

- Depending on the way the amount of new (virgin) materials are minimized it could either mean higher or lower building costs. In the current situation biobased and secondary materials are often more expensive than new virgin materials. This is due to the mass production of new virgin materials, leading to a lower unit price. It then may be the case where these higher costs can lead to lower market value determined (due to an indirect lower profit), but currently, there is no direct implication, but there is potential to explore further in that area.

(-) Higher investment costs, while benefits stay the same = (-) potential lower market value

- Minimizing the amount of new (virgin) materials could also be obtained by optimizing the design. In this case the total amount of materials used is reduced, leading to lower overall lower building costs and thus a higher profit for the developer. Ideally, here as well, there should be potential for a higher market value of the building because of higher profits, but just as the previous case, there is no evidence of a direct impact yet.

(+) Lower investment costs, while benefits stay the same = (+) scope/potential for higher market value

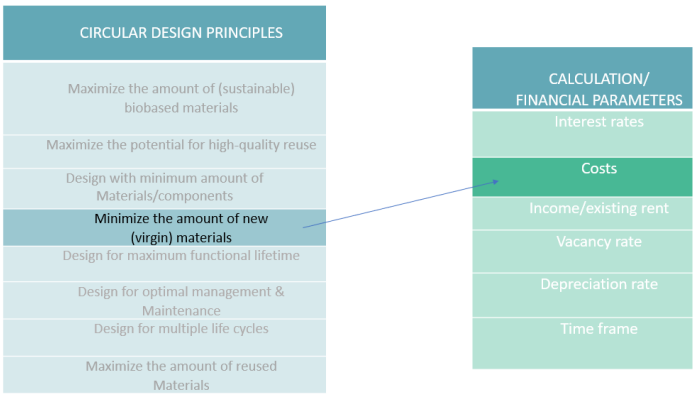


Figure 32: Association between Circular Principle 4 and Valuation Parameters

5.3.5 Circular Principle 5: Design for Maximum Functional Lifetime (adaptable buildings)

While the definition, description as well as examples of this have been elaborated on in the theoretical background of *Circular building principles*, the implication on valuation parameters will be discussed below.

The most circular building is one that is used in the same location endlessly, and it is crucial to design a building that is not optimized for one specific function at one specific moment in time, to maximize the functional lifetime. It has implications on 'vacancy rate', 'cost', 'income', and 'time frame' parameters.

- Vacancy Rate: Due to ease of long-term adaptability to client requirements, buildings are occupied for longer durations and contain high demand. Whenever the functional need changes, or even when a specific function isn't needed anymore, these kinds of buildings can easily adapt while minimizing the construction time. This leads to lower vacancy rates during the usage phase, thus a potentially higher market value.

  (+) Lower vacancy rate = (+) higher income = (+) higher market value

- Cost: To design a building that isn't optimized for a specific function, often there needs to be some sort of oversizing. This could possibly lead to higher building costs. It may be the case where higher costs directly lead to lower market value determined, but there is potential to explore further in that area.

  (-) Higher investment costs = (-) potential for lower market value

  On the other hand, since these types of buildings can be easily adapted to different functional needs, the transformation costs are lower than traditional buildings. Here as well, higher savings lead to higher profits, and this translates to higher income (also because of lower vacancy rate), meaning the property value would be calculated to be higher, because of new potentially higher income.

  (+) Lower transformation costs = (+) higher market value

- Income: Because the building is adaptable, it is possible that higher rents can be asked as the building is capable of completely adjusting to the specific demands of tenants.

  (+) Higher income = (+) higher market value

- Time Frame: Because sustainable materials are more expensive currently, it will take a longer duration to earn back higher investments as compared to cash flows predicted for non-sustainable materials, making it riskier to invest.

  (-) Longer recovery period = (-) higher risk

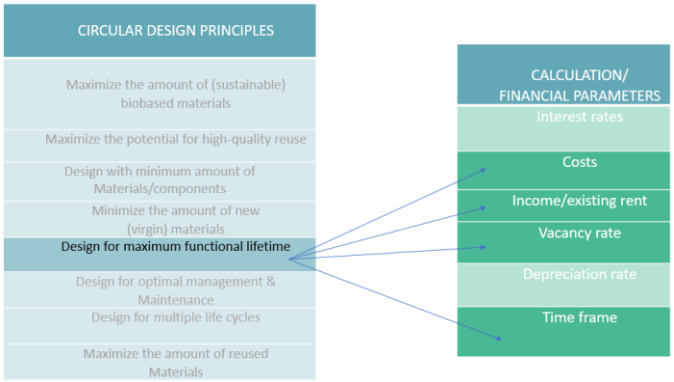


Figure 33: Association between Circular Principle 5 and Valuation Parameters

5.3.6 Circular Principle 6: Design for Optimal Management and Maintenance

The definition, description as well as examples of this have been elaborated on in the theoretical background of *Circular building principles*. The implication on valuation parameters though, will be discussed below.

Operation, Maintenance, and Repair Costs are greater than three times the cost of initial construction. Having such a profound impact, it is important that operations and maintenance considerations are discussed at the beginning of construction to optimize the life cycle of a building. It has an implication on 'vacancy rate' and 'cost' parameters.

- Vacancy Rate: If a building is designed for optimal management and maintenance, it means that it is designed in a way that less maintenance is required (less impact, both financially and ecologically), leading to less disturbance to the tenants. This could potentially mean that due to high demand and satisfied tenants the vacancy rate goes down, as there are fewer activities during the period of usage. A lower vacancy rate leads to higher income, thus a higher transaction and market value of the property.

(+) Lower vacancy rate = (+) higher income = (+) higher market value

- Cost: A higher initial higher investment for developers to design and construct such structures, can lead to visible lower costs for investors/users in terms of less effort, time and money used for relocation, renovation, maintenance, and repairs. The costs during operations go down, leading to higher savings (thus more income) and a potentially higher market value.

(+) lower maintenance costs and (+) lower operation costs = (+) potential higher market value

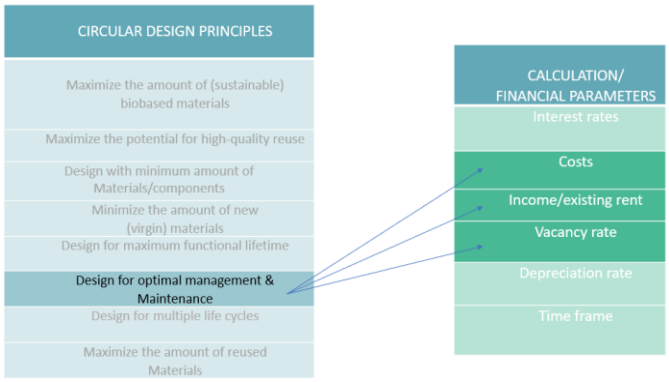


Figure 34: Association between Circular Principle 6 and Valuation Parameters

5.3.7 Circular Principle 7: Design for Multiple Lifecycles

The definition, description as well as examples of this have been elaborated on in the theoretical background of *Circular building principles*. The implication on valuation parameters though, will be discussed below.

Whenever a building cannot stay at the same location, it should be reused in the most valuable way. To reuse in the most valuable way, it is important to design in a way that products can be easily demounted. It has implications on 'vacancy rate', 'cost', and 'income' parameters.

- Cost: There can be potentially higher investment for developers to design and construct such structures.

(-) Higher initial building costs

But, since these types of buildings can be easily adapted to different functional needs, the transformation costs would be lower than traditional buildings. Here as well, higher savings lead to higher profits, and this translates to higher income (also because of lower vacancy rate), meaning the property value would be calculated to be higher, because of new potentially higher income.
Having a demountable building can lead to lower costs for investors/users in terms of less effort, time and money used for 'demolition' or relocation, especially when it is known beforehand that the building will be temporary, like for example, many student houses being built in the Netherlands.

(+) Lower 'demolition' costs = (+) higher market value

- Vacancy Rate: Due to lesser time take to adapt to client requirements, buildings are occupied for longer durations and contain high demand. Because of this demand and potentially satisfied tenants, the vacancy rate can be lower, leading to a higher market valuation.

(+) Lower vacancy rate = (+) higher income = (+) higher market value

- Income: When a building is completely demountable, the reuse potential is significantly higher. This could lead to a higher residual value for the building when it will be demounted, leading to profits and a potential higher transactional value when it is resold.

Higher residual value (+)

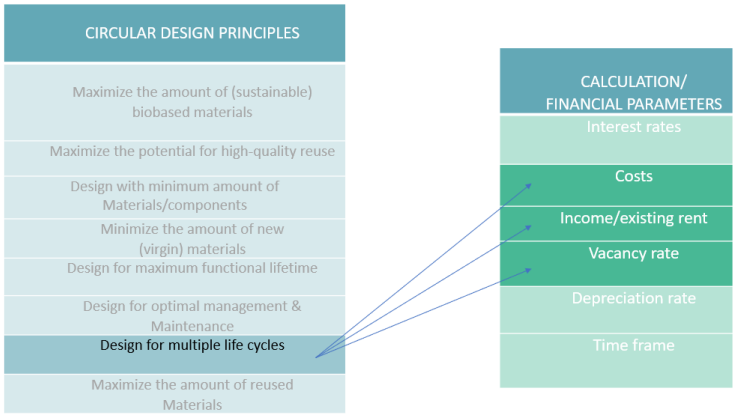


Figure 35: Association between Circular Principle 7 and Valuation Parameters

5.3.8 Circular Principle 8: Maximize the amount of Reused Materials

While the definition, description as well as examples of this have been elaborated on in the theoretical background of *Circular building principles*, the implication on valuation parameters will be discussed below.

Building with reused materials has two benefits, it has a lower carbon footprint, and it prevents extraction of finite resources from the earth. It has an implication on 'interest rate' and 'cost' parameters.

- Interest Rate: More banks are offering 'green loans' with lower interest rates than regular loans. When it can be proved that a building has a significant amount of reused materials, there is potential for a green loan. A lower interest rate thus results in a higher market value.

(+) Lower interest rates = (+) higher market value

- Cost: In current times, the costs of reused materials are unfortunately often higher. This is due to high labour costs and there is no mass production advantage for circular products yet. It then may be the case where higher costs can lead to lower market value determined, but currently, there is no direct implication, but there is potential to explore further in that area.

(-) Higher investment costs = (-) scope/potential for lower market value

This could, however, change gradually when the raw material prices keep rising as they have over the past years. It could be possible that in the upcoming years the costs of reused materials are lower than raw material prices.

(+) Lower investment costs = (+) scope/potential for higher market value

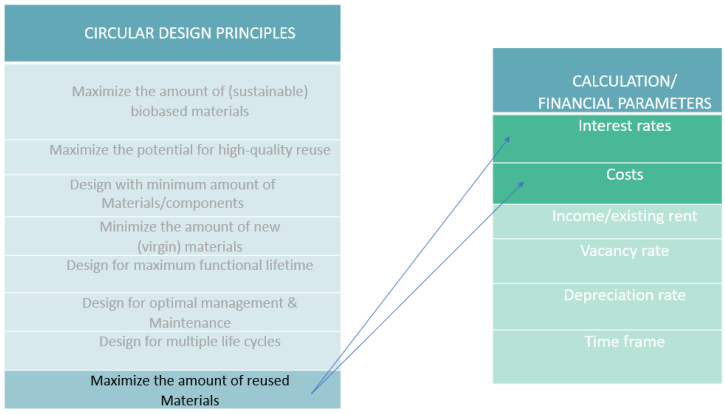


Figure 36: Association between Circular Principle 8 and Valuation Parameters

This analysis conducted here is the crux of the research, which helps answer the main research question. Each parameter as well as the circular principles (which are elaborated in the theoretical background) are studied to find their links with each other. While some have a direct impact, some still have potential to explore further as there is no direct impact seen yet. But this analysis conducted here is the first step towards establishing that Circularity can be imbibed within Valuation, and this is the route that can be taken.

As part of the prescribed Delphi methodology, a manual prepared as summaries of the findings from Delphi Round 1 were shared with stakeholders for Round 2, to arrive at a consensus about the findings. This has been elaborated on below.

5.4 Delphi Round 2

As a part of the Delphi Methodology, the second iteration is based on the analysis and findings of the first round. The above-discussed interview findings, as well as analysis, are curated in the form of a questionnaire. These are then primarily sent out to valuators for their opinion, validation, and consensus since they are the main stakeholders the research is orchestrated towards. Within the survey, a few open questions were also included for stakeholders to express why they agree/disagree with a certain connection, as well as to what extent they agreed with the descriptions of each parameter. This allowed for the questionnaire to have scope for explanations for their choices. The primary reason for choosing valuators for this survey is that they are the recipients of the research. It is important to get an agreement on the usage of their parameter terminologies, as well as how feasible they felt the recommendations were. The results of the open questions and suggestions about each parameter are described below, post which the statistical data from the survey is expressed and analyzed. It is to be noted that the structure of the survey was designed in a way that would be easiest for RE Valuators to grasp, as well as more weightage was given to their agreement on the description of how parameters could be broadened, as compared to Circular

validations. Hence, although the survey was worded differently keeping in mind the interests of Valuators, the content remains the same. A sample survey form can be found in *Appendix D*.

5.4.1 Theoretical Data from the survey

As mentioned, certain questions in the survey were open ended, allowing for valuators to give their opinions on some of the hypothesis. Since they are interesting to know, some of them have been highlighted below, pertaining to each valuation parameter.

Cost

According to one of the survey responses to the explanation of the cost parameter; in development and investment, he believes that investors also calculate the savings on costs if they own and operate the building. If they do not operate the building, it might not be necessary, because the maintenance and operational costs can sometimes be calculated and directed towards the lessee/user.

Another survey respondent agreed, as well as added to the description of cost in terms of it being highly dependable on investors with a long-term focus (no short-term gains). Therefore, the savings, in the end, must (guaranteed) make up for the higher investment in the beginning. This is however hard to predict and maybe legislation can play an important role in this factor (e.g., buildings require a minimum energy label or energy usage).

Interest Rate

A respondent strongly agreed with the description as well as the linkages. According to him, there is a lot of discussion about not only circularity but ESG as a necessity. The more these factors are promoted by the institutions, the faster we can move towards it.

Vacancy Rate

Although agreeing to the description of the vacancy rate parameter, a respondent had some comments. According to him, ***"The 'adaptability/flexibility' becomes more important when there are more short-term users. When the space is rented for 5 years or more, it is questionable whether a higher investment upfront will lead to saving over the whole timespan of the buildings. This is also dependent on the costs of 'adapting' the building for a new user versus traditional 'adaptability' of demolishing the existing structures and building a new space/room/structure/lay out."***

These recommendations were considered to create a final, updated version of the manual, which can be found in *Appendix E*.

5.4.2 Statistical Data from the Survey

21 Valuators from the Netherlands responded to the survey. As elaborated above, the questionnaire started with some background and context about the valuation parameters considered, along with a short explanation of circular design scenarios and the principles of circular design. Further, the link between each individual parameter is displayed, followed by the explanation of the usage of each parameter in this context. Open questions for each are provided in case a valuator would like to specify comments or explanations for their responses. The respondents were asked to choose values on the Likert scale for whether they agreed to the descriptions of valuation parameters, as well as choose a 'yes' or 'no' to visualizing the link with circular parameters. The latter validation would provide more weightage when conducted with circularity consultants, and that is the aim of the verification and validation session as well.

The pie charts below contain a brief visual of the results of the survey. While the first chart is information about the number of years they have been in practice, the remaining 5 pie charts talk about to what extent valuators agree with the linkages for each parameter discussed. Here, keeping in mind that circularity is not their forte, this question was asked to see if valuators could visualize the hypothesis in some way. Additionally, even if valuators did not see potential yet, these descriptions introduced them to the concepts of this connection, where the idea was transmitted to various potential recipients of this report even before a final version was created.

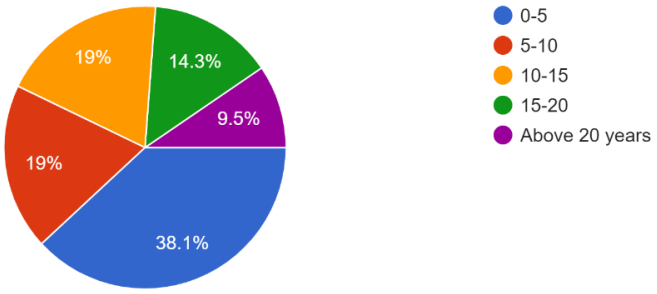


Figure 37: Experience level of valuators in the industry

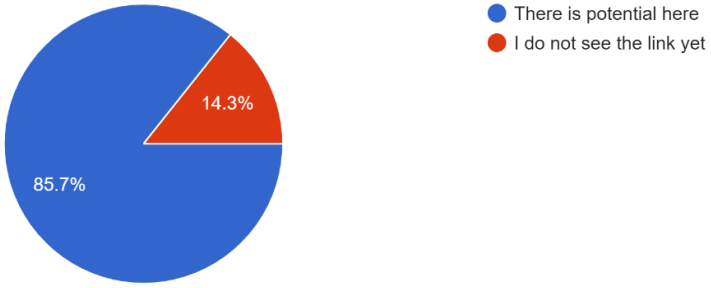


Figure 38: Association between 'interest rates' and Circular Principles

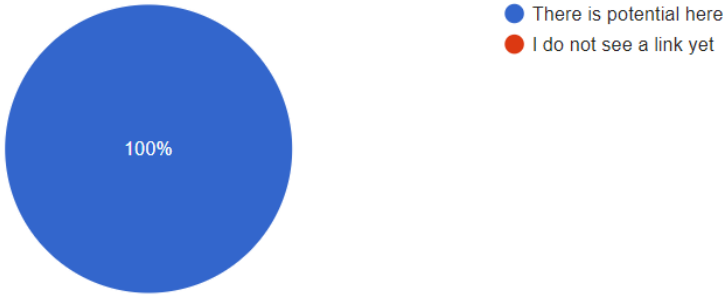


Figure 39: Association between 'Cost' and Circular Principles

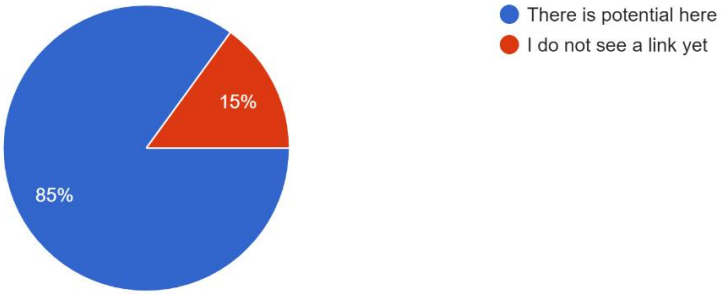


Figure 40: Association between 'Vacancy rates' and Circular Principles

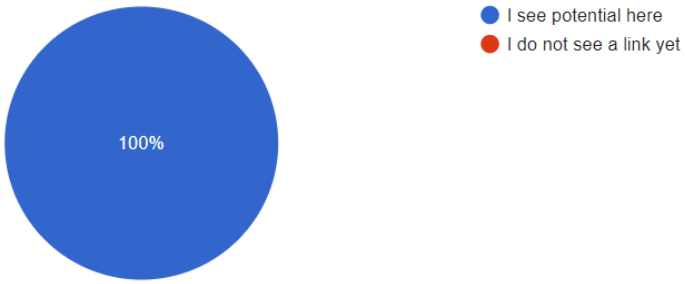


Figure 41: Association between 'Time frame' and Circular Principles

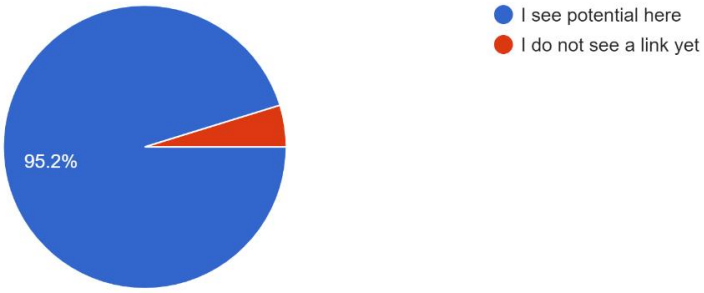


Figure 42: Association between 'Income' and Circular Principles

Below is the validation received for the explanation of each parameter recommended in the hypothesis. This table must be given more weightage than the previous charts because the questions asked in this section are directly related to the Valuation profession. Hence their validation to the theory to their area of expertise shows a good sign. This data is prime because it shows that valuators do see a potential in the recommended descriptions of circular-driven valuation parameters. An average mean of 4 suggests that most respondents so far do agree to the provided division. There are certain descriptions that are more agreed upon than the others. This, as an exploratory analysis implies the need for further research in those domains, with the potential of more accuracy and concrete definitions of certain factors.

	Mean	Standard Error	Median	Mode	Standard Deviation	Sample Variance	Kurtosis	Skewness	Range	Minimum	Maximum	Sum	Count
Do we agree with the **classification of the parameters for valuation of a property**? (The division of factual versus subjective parameters)	4,142857143	0,125085005	4	4	0,573211504	0,328571429	0,318044639	0,035929086	2	3	5	87	21
To what extent is the explanation of **interest rates** feasible, according to you?	3,904761905	0,136360201	4	4	0,624880941	0,39047619	-0,11177557	0,056493432	2	3	5	82	21
To what extent is the explanation of the **cost parameter** feasible, according to you?	4,19047619	0,1635768	4	4	0,74960307	0,561904762	2,492477963	-1,12399659	3	2	5	88	21
To what extent is the explanation of **income** feasible, according to you?	4,047619048	0,145997235	4	4	0,669043382	0,447619048	-0,49784375	-0,05188669	2	3	5	85	21
To what extent is the explanation of **vacancy rate** feasible, according to you?	3,857142857	0,221313334	4	4	1,014185106	1,028571429	2,15338694	-1,27792513	4	1	5	81	21
To what extent is the explanation of **time frame** feasible, according to you?	4,095238095	0,181327931	4	4	0,83094897	0,69047619	0,4978284	-0,76705862	3	2	5	86	21

Table 8: Survey Results

5.5 Validation of the Outcome

The final step of the design process includes a validation session with experts as part of the last phase of the research technique and the focus on practice and implementation of this topic. Following the strategy's conception, an in-person session with experts was held to provide comments on the strategy's uniqueness, applicability, and viability. As a result, the link between circular concepts and valuation factors were established. Each circular principle was discussed in depth in terms of their scope and usage. The primary potentials and areas for improvement were agreed upon by the professionals in attendance at the end of the session. The experts were asked to give their opinion on each of the links between circularity and

valuation. They elaborated upon their issues with the framework, after which the researcher and the experts could brainstorm solutions to the problem. The most prominent comment that rose from this discussion was to make the final framework easy to read and more cohesive. The experts chosen are circular consultants, but with varying backgrounds of working in a bank, a law firm, and policy making, allowing for broader perspectives.

The final framework of the analysis can be summarized in the form of a manual for valuators, a synopsis of the manual in a table, which is described below, and a short step-by-step check list for valuators. The manual has been updated in *Appendix E*.

	Calculation/ Financial Parameters					
		Interest Rate	*Costs*	*Income*	*Vacancy Rate*	*Time Frame*
Circular Principles	*Maximize the amount of sustainable bio-based materials*	Green loans (lower interest rates) allotted by banks	Higher investment costs, lower operational costs	Higher savings, thus larger profit, thus higher income		Longer duration of time needed to earn back investments
	Maximize the potential for high-quality reuse			Satisfaction of clients leads to lower vacancy rate, leading to more consistent income	Satisfaction of clients leads to lower vacancy rate, leading to higher valuation	
	Design with minimum amount of materials		Lower costs due to lesser materials to be purchased			
	Minimize the amount of new (virgin) materials	High interest rates lead to lesser amount of components.	Helps investor mitigate risks related to increasing costs of traditional materials (due to scarcity)			
	Design for maximum functional lifetime		Higher investment, but lower costs due to reduced need for relocation, renovation, and repairs	It is possible that higher rents can be asked as the building is capable of completely adjusting to the specific demands of tenants	Ease of adaptability to client requirement leads to lower vacancy rate, leading to higher valuation	Longer duration of time needed to earn back investments
	Design for optimum management and maintenance		Higher investment, but lower costs due to reduced need for relocation, renovation, and repairs	Adaptability to client requirements implies lower vacancy rate, leading to more consistent income	Ease of adaptability to client requirement leads to lower vacancy rate, leading to higher valuation	

	Design for multiple lifecycles		Higher investment, but lower costs due to reduced need for relocation, renovation, and repairs	Design and usage for longer duration ensures steady income for a long period of time	Ease of adaptability to client requirement leads to lower vacancy rate, leading to higher valuation	
	Maximize the amount of reused materials	High interest rates lead to lesser amount of components.	Lower costs due to lower materials to be purchased			
To what extent is it agreed upon?		3,90	4,19	4,05	3,86	4,10

Table 9: Matrix describing how Circular Principles can have an impact on Valuation Parameters

6. Discussion

This chapter dwells upon the primary themes arrived at from the analysis. First, the research criteria discussed in the methodology are assessed, whether they have been met or no. Then, the applicability of the guidelines in practice is deliberated upon, whether it is feasible or not.

6.1 Verifying research criteria

This portion dwells on whether the research criteria mentioned in the research methodology are achieved, and if yes, how.

6.1.1 Reliability

Reliability signifies that the data collection and measuring instrument utilized in the quantitative section of the study are trustworthy, with a selection of a consistent data set. With this research, by restricting the research group to one domain, i.e., the real estate industry, the data collected tends to be consistent. The interviews and surveys conducted are with experienced and reliable developers, investors, banks, and valuators from the industry. This ensures that data collected is from trustworthy sources, and directly from the changemakers and forerunners in the industry. This makes the thesis research stronger in terms of data backing.

6.1.2 Reproductivity

Since the data has been collected from stakeholders within the real estate industry, and the survey conducted was predominantly amongst property valuators, there is scope for reproductivity of this research in larger settings as well. The only distinctiveness here is that valuation is partially subjective and an individualistic decision at a certain level. Hence, it is unlikely to have a directly replicated outcome in a different setting. The thought process, experience, and level of openness of the valuator play a substantial role. On the other hand, each step and decision taken has been elaborated on in the report, making it easy for replication of the procedure when the need arises.

6.1.3 Validity

The validity of the research was tested against stakeholders in the industry, various professional property valuators in the Netherlands, as well as circular consultants from various backgrounds. Hence, the research could be labeled as valid.

6.2 Applicability of the Guidelines in Practice

6.2.1 Summary of Key Findings

To grasp where and how this research can be relevant in the practical world, it would first be appropriate to revisit why this research was chosen in the first place, and what was the pressing problem that the researcher believed required attention in this thesis. To start with, the circular economy is relatively new and upcoming, as well as not yet well known among all industries. Hence, for industries to apply circular principles, there is a tremendous amount of research and innovation done to incorporate it in practice. In such a case, it is natural to want to be able to witness the benefits of this transition. This brings us to the second part of the research, real estate valuation. Via various valuation methodologies, experience, and some level of decision-making and predictions, it is possible to place a value for every building constructed. This, over the years, has been done by analyzing previously constructed buildings, and appropriate comparables. This worked out systematically until newer, more sustainable design strategies came into the picture. It brought about a need to also find ways of incorporating those new solutions into a tangible form. That is what this thesis aimed towards. To consider the black and the white from the circular economy and real estate valuation and form a grey area that is open and accepting to inclusions and can eventually account

for these new constraints. This grey area will allow for more room for interpretation of what a property value entails, what is it based on, and where this is further room for subjectivity. By applying the discussed guidelines in the valuation process, there is potential for various professionals from the real estate sector to have more incentive to develop sustainable strategies. They will then know that circular and sustainable design will eventually lead to accountable value (either positive or negative).

A second challenge that this research aims to address is the concept of a vicious circle of blame. The knowledge and technologies required to develop sustainable structures are already in place. The economic benefits of environmentally friendly design and construction are becoming more widely recognized. What is getting in the way is the misalignment of incentives between building providers and individuals who will invest in or inhabit structures. This is referred to as the 'vicious circle of blame'.

To make it more contextual, each stakeholder within the industry believes that the frontrunners to the transition to sustainability is someone else. Each wait for the other to bring about decisions that will then pave the way forward towards firm sustainable goals. After various interviews and discussions with professionals, a common consensus was unanimously established where the government and municipality are considered forerunners to initiate change. Several developers who are already into sustainable construction mostly did so because they knew the market was heading in that direction, and the only reason it is not transitioning fast enough is due to the lack of regulations. Once those are in order, then everyone paves way for it in their businesses. Each one then further innovates based on growing with the new rules. Although finance is a primary parameter, new regulations might alter the definition of 'expected cost' or 'average value', and there will be a new one, which will then be deemed as standard. Every stakeholder had valuable recommendations in terms of additional legislation that could be provided in their industries, to aid this transition, which was discussed in the interview analysis results.

Additionally, what emerged from this was then a discussion about how even though there might be a 'start point' to break this circle, there is a moral obligation for each stakeholder to individually include sustainable decisions and practices within their domain of expertise. This ensures constant growth towards the doing good environmentally, without being legislatively obligated to do so.

As a researcher's view on the applicability of the connection between circular design and valuation parameters, there were certain observations. The recommendations provided to real estate valuators are more of 'first steps forward' towards the consideration of incorporating additional viewpoints in their already existing valuation methods. It is predominantly to 'plant a seed' in their minds, about the possibilities of circular inclusion within their practices. The usage of them, however, will partially depend on each valuator and their interpretation of what value it brings into the project at hand. This is especially in the initial transition phase, where there are no strict rules to follow and provide substantial objective backing for each decision. Because of this subjectivity, the guidelines in the manual also try to be more concrete, for the sake of clarity and lower chances of misinterpretation by each valuator. Hence, sharing the analysis with valuators was an important step to visualize to what extent valuators are in consensus about the same.

When additional proposals or guidelines are put forth to a professional, it is reasonable to assess if they require a supplementary skill set, to be able to interpret new scenarios well enough. In the case of this research, there does not seem to be a need for additional specific skills. Every valuator is well educated to assess all aspects of the factors considered for valuation. One recommendation might be to be receptive to unfamiliar forms of interpretation. With new design strategies and principles (such as the circular economy), there comes the added dimension of being welcoming, flexible as well as knowledgeable about it. One primary barrier towards this receptiveness is not having adequate knowledge about the circular economy. This research reduces that gap, by illustrating ways in which there can be a link between circularity and

valuation. In addition, when such interventions are brought into building design and are then expected to be translated into values, the valuator should be willing to enter elaborate deliberations with clients, to see their perspective of the added/changed value. They should be open to the possibility of having detailed reports for each property valuation.

6.2.2 How does this research build on existing Literature?

For a thesis project to be complete in all senses, there needs to be an addition of knowledge or value added to the existing literature. This portion will briefly elucidate on how the knowledge of what was already known, is enhanced.

With respect to the Real Estate Literature, this research has helped broaden the definition and as well as direction and ways of interpretations of parameters by the valuators. The existing literature defines the usage of the parameters of valuation in a certain way, which has been followed as a standard for very long now. This research expands that horizon, for the valuators. Hence when new projects arrive, with a hint of circular design principles, valuators will have an initial road map of how they may impact the value of the property.

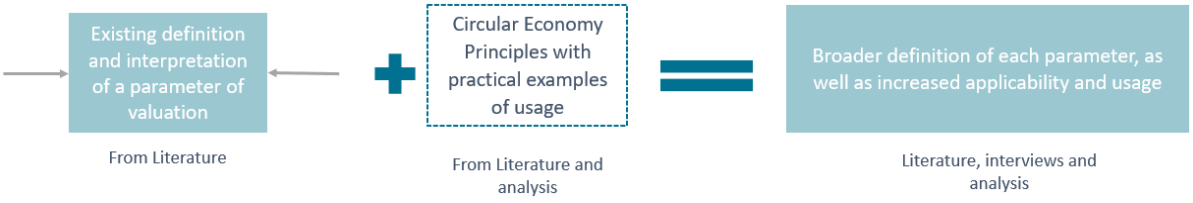


Figure 43: Knowledge addition to Real Estate Literature

Additionally, this research can be used by Circular consultants anytime a client from the building industry requires a reason to invest in circular design strategies and would like to see the impact in the translated design. This report suggests a start to how valuators can incorporate circular values in their report, which, when established, will be a big step forward.

When looked at it with another perspective, since Circularity is still an upcoming way of living, any research conducted to further enhance it or add clarity, is added value and knowledge for future Circular users.

6.2.3 Added dimension due to the Methodology of the Research

During the research, there were certain observations about the results obtained from the usage of this particular methodology, which is worth discussing. While the Delphi Technique is known to aid in finding consensus towards the end of the research methodology, there is reason to believe that the methodology has a larger role to play in orchestrating the outcome of the research, rather than just extracting results. While in the first round of the Delphi information is obtained from stakeholders based on their methods of practice and opinions, the second round is a survey which is based on the first round. This means that the data posed to valuators in the second round has the potential to plant a seed of the idea of circularity in valuation techniques, even before it is officially implemented. It makes the valuator consider the possibility when coming to face with clear depictions of potential ways of taking it forward in their practice.

Hence, due to the nature of the methodology, it helps propose a hypothesis to the required target group even before the proposal has reached a concrete stage. This can often steer the mind of certain professionals to already think in that direction, for further possibilities.

6.3 Reflection of the Strategies indicated

The researcher concludes the discussion chapter by reflecting on the designed approach to establish its meaning and application. While the analysis spoke in detail about the financial parameters of valuation, this section will elaborate more on the impact of the key drivers of valuation in the circular transition.

The ***type of investors***, although not having a direct translation to value, is one of the primary drivers or initiators of change. The process of change begins with the belief and mindset of the investor, in this concept. This was agreed upon by most of the interviewees. Currently, the growth of the Circular Economy is at a stage where although there are various benefits to it, these cannot be seen in the current lifespan, or even directly by the users of the concept. It is more towards preparing for a better future, for the following generations. In such cases, it is difficult to invest in what is not directly visible to you. Investors with a vision for the future will put in that extra effort financially as well, to enable progress towards change. Additionally, when an investor believes in the impact of sustainability, he is also more prone to value a property higher than what is shown on paper. This has a levy on the market price, which is strongly dependent on supply and demand in the economy. If an investor does not support a developer who has invested higher to allow for sustainable design, then the chain gets cut right at the beginning. Hence, despite envisioning those legislative decisions will enable the adaptation of circular practices, a lot lies in the vision of a real estate investor. Additionally, an interested investor will also put in that effort to have elaborate discussions with the valuator, explaining why they see a higher value in a property. If valuators are convinced with their justification, there is scope for changes in the originally calculated value (as substantiated by one of the interviewees as well).

Several literature articles talk about the concept of ***supply and demand***. It is the crux of the growth of the economy, and unless there a constant growth in the economy, it is hard to create a balance between the two. The supply and demand for real estate in a given location are inversely proportionate. On the demand side, factors such as population growth, personal income, and people's interests and preferences must all be considered when determining a property's value or future worth. On the supply side, the available supply of real estate properties and their relative scarcity must be considered (Lawrence, 2014). When the supply of real estate property is limited and the demand is high, land or property value prices rise. In contrast, where land is plentiful, but purchasers are few, supply and demand will be kept in check or balanced at merely a few cents per square foot. There is then a direct relationship with the vacancy rate as well. When demand is low and supply is higher, then the vacancy rate goes high, leading to lower property values. Now assessing this with the circular economy, there is no demand yet because not too many industries know about it, or are unsure how to implement it, nor are there any strong regulations yet that compel industries to apply it. This inversely leads to lesser supply. For example, currently, there is no requirement for using second-hand materials in new construction projects. Although declining, there is no visible shortage yet. Hence, even if some developers would like to construct with secondary components, there is not enough supply in the market for it. There is no set database to know where to procure all of them in a good enough condition to reuse them. Only with rising demand will industries try and innovate to arrange for supply. One way to initiate this process is to edge developers to use components of the previous building, in case of redevelopment projects. This will reduce their costs of construction, and invariably lead to higher profits. Secondly, the creation of material passports for new construction would provide sources of supply ready for future developments when these buildings would be harvested. This would enable a higher residual value for properties at the end of their lifetime. It allows for longer usage of components, rather than disposing them away. Although far-fetched, these are factors that can aid in considering the circular economy in property values.

Something to recognize is that national ***governments*** are in a unique position: they have the power to initiate discussions about social goals and to foster collaboration among all actors in society, resulting in increased welfare for their citizens. Governments have a variety of tools at their disposal to accomplish this, ranging from developing national policies and assembling stakeholders to informing citizens about national goals. As deciphered in literature, as well as by all the interviewees, each stakeholder is anticipating that government relations and policies will be the primary driving forces to transition to sustainable and circular practices. Even if no formal national circular economy strategy exists, various policies and tactics are likely to assist the circular economy to some extent. Through discussions with interviewees, various legislative recommendations were put forth, which stakeholders believed would help advance the transition. Suggestions in the lines of introducing a distinction in the way property taxes are levied are an interesting find. Currently, the property transfer tax is based on certain fixed factors, which does not include

sustainability as one of them. If they were to lower transfer taxes for sustainable or circular buildings, it would incentivize more builders as well as investors to expand projects in this domain. Similarly, concerning the upcoming regulation about levying carbon dioxide taxes on construction practices, the suggestion was to make this an annual payment, rather than a one-time fee. As stated by an interviewee, **"*it is not hard for developers to find loopholes to avoid this fee by transferring it onto the municipality as a deduction from the residual value.*"** Imposing this tax annually might have a larger impact on developers, to make conscious design and construction decisions and assess the consequences of it. Additionally, the need to reassess the acceptable construction materials by the Dutch government was an important discussion, as well as a significant barrier. Interviewees expressed that even though they were putting in all the effort to innovate and design with certain bio-based products and materials, most of these were not registered as 'acceptable' materials for construction by the authorities. This disables interested stakeholders from transitioning to bio-based materials, as they do not have a '30-year proof' of the material durability yet. For the Netherlands to transition to a circular economy, the government needs to implement several policy changes to allow for the same. If not, then stronger incentives need to be explored.

Similarly with ***energy labels***. In present-day valuation practices, although there are descriptions of the energy labels and specifics about the building, there is no direct impact of it on the property value. A step is taken towards this by the introduction of mandatory minimum label C for all office properties in the Netherlands. This means that the next move to incentivize all developers and investors to do so would be to account for these energy certificates in the physical value given. This is visible proof of the additional interventions that had to be incorporated. This regulation also makes it interesting to see how buildings with lower energy labels will be upgraded. Would they be transitioned to other usages, or upscale to higher energy labels? Whichever is the outcome, it is most likely that modular interventions would be the most plausible strategies to go forward, considering the building is already constructed. This allows investors as well as valuators to ponder over the impact of such techniques on the final value. Would it grow higher, or would it have no impact at all? The goal of the researcher here is to get relevant stakeholders thinking in the desired direction and providing opportunities when they do want to progress towards circularity.

7 Conclusion and Recommendations

This study investigated the problem of not being able to demonstrate a translation of circular interventions into a property valuation segment, and hence no influence on the final value. The findings of this study suggest that there may be a link between circular principles and property valuation characteristics. The main research question which has guided this study was: ***"How can Circular Strategies be implemented in Real Estate Valuation practices?"***

The research began with a review of the literature. Following that, many interviews with real estate industry respondents were done, followed by a session with an interdisciplinary team to validate the established strategy. These processes were orchestrated by a research technique known as the Delphi technique to answer the central question.

The report is organized in such a way that each chapter responds to one or two of the sub-research questions. The final responses to the research and sub-research questions have been explained below. Furthermore, the research limitations are highlighted, as well as the corresponding recommendations for future research and practice.

7.1 Answering the Sub-Research Questions

This part begins by responding to the sub-research questions before moving on to the primary research topic.

1. ***What is the Circular Economy, specifically within the Built Environment?***
   The built environment consumes a significant amount of natural resources. To eliminate waste and boost efficiency, it recognizes the need to fundamentally modify the processes, components, and systems it employs. The circular economy model is a new way of thinking about growth. It consumes fewer resources, has fewer negative environmental consequences, and is less reliant on volatile natural resource markets. A circular economy can improve resilience as well as being more sustainable. It may offer flexibility and capacity to a variety of scales, including individual assets, communities, cities, and even entire economies. Hence, it comes across like the circular economy can help solve the current problems the built environment is facing and creating.
   The literature and theoretical background on the Circular Economy covers aspects of its definition, the requirement in the building industry, as well as application of the circular design principles that are relevant to this research. Since the concept of Circular Economy is at its nascent stage, there are multiple definitions as well as variations of principles in use. Hence, although they are all relevant and similar, the research adapts those definitions of principles that directly encompass most characteristics of circular building strategies.

2. ***What are the current methods of Real Estate Valuation for commercial, office properties, and what is the link with Circularity?***
   The valuation industry has a fixed set of methods and techniques that have been used to assess property value. Over the years, they have been combined and used interchangeably in most projects, as it helps to arrive at more accurate results, with adequate objective backing. Four methods of valuation are discussed in detail in the theoretical background of valuation. These are shortlisted as being the most used methods for commercial property valuations. It was important to then capture the factors that influence the value of a property. Post that, through various discussions with valuators, the researcher arrived at a classification of the parameters of valuation. It was primarily based on the statement that ***"Each property valuation is predominantly objective, but there is a small portion that is subjective, based on the individual valuator, and within this small room, there is potential to tap at circular values".*** The objective and subjective sides were discovered, which enabled the

research to narrow down the parameters that could incorporate circular design principles when needed and have a deeper discussion over those.
Additionally, what should be noteworthy is that there are already some circular interventions within the real estate industry, that try and focus on salvaging residual value towards the end of life of a building. These are calculators that help assess the residual value of materials upon reclaiming them. They are business models that would be viable to be placed at the bottom of the value hill in the value recovery stage. This research though, dwelled upon factors that had a more subjective approach, and where the role of the valuator is essential to the result. That was the focus because such factors have not been discussed in the industry yet, and the researcher believes it to have the potential to provide a higher value in the value recovery stage of the Value Hill model.

3. ***What kind of stakeholders are involved in the process of Real Estate Valuation, what role do they play and how would they benefit from circularity?***

The third part of the theoretical background advanced onto the analysis of relevant stakeholders from the real estate sector. This was done due to the nature of the research. The research was predominantly dependent upon conversations with members from the sector, to discuss, assess and ask questions about their practices and vision. Hence, it was vital to do a short study on who each of them is, what kind of role do they perform, their importance in the industry, and where in the chain of construction do they fit in. Circularity is so much about collaboration and discussing various interactions they have with other stakeholders along with how it impacts their work, which makes it more important to be in consensus. In this research, there was a unanimous consensus about the government bodies being forerunners in the transition to circularity, and how they could implement policies that would help see the impact of circularity on property values better. It was interesting to probe into what the benefits of circularity would be for each stakeholder. This unfortunately did not bring out many positive replies as stakeholders do not have complete clarity of what exactly the circular economy entails. Currently, the main reason they are a part of the transition is to stay up to date with innovations and be ready for more permanent transitions when regulations have been established.

4. ***What are the primary opportunities and barriers encountered in this transition?***

The final sub-question was curated to fit in the final piece of information that would aid in establishing a link between circular economy principles and property valuation parameters.
Any impediment to realizing one's full potential that can be overcome by policies and procedures is referred to as a 'barrier'. The use of technology or policies to lower costs and difficulties, discover new potentials, and expand current ones is referred to as an 'opportunity.' Potentials, constraints, and opportunities are all context-specific and change over time and across locations.
In this research, various barriers, as well as recommendations, arose from interviews with professionals. This was needed to establish the link (or gap) between literature and the practical world. While literature can provide detailed guides or explanations to various concepts, the practical scenario faces impediments that are probably unknown until physically tested out. Several practical issues as well as suggestions were raised, which served as a basis to design the link between circular strategies and valuation parameters. The concept of substantiating circular principles with practical examples arose from this gap with literature. Various recommendations that came forth from professionals were used as examples for scenarios for circular principles usage.

7.2 Answering the Research Question

How can Circular Strategies be implemented in Real Estate Valuation Practices?

To start with, the main crux of this research would be that there can be a link between circularity and valuation, and it can be implemented within the current valuation methodologies. The thesis research explains how the connection is possible, along with some practical scenarios for each of them. A short

manual is made to present to valuators, as a guideline or 'checklist' for the same. The list of scenarios that are possible are infinite, as there can be various other ways (apart from the ones mentioned) in which circularity can be incorporated. Hence this research is not restricted to the examples mentioned. That being said, although there is potential for the connection between the two, it is *not visible in the present day*. This is backed up by an analysis of various valuation reports that highlight the factors of sustainability but do not account for them. Discussions with interviewees also validated the same. Currently, while there is no impact of circularity and sustainability on the final value of a property, there is a visible difference concerning a reduction in costs in using harvested materials, as well as in the operations and maintenance with respect to energy savings in sustainable buildings. The transition to value on paper still needs to evolve, and that is where this research poses as a mode to initiate this idea. Below is a summary of the linkages, along with in what way each Circular principle would impact a Valuation parameter. A short formula depicting the impact (positive or negative) on each parameter is indicated. The numerical values in the last row indicate the scale (1-5, 1 being lowest) to which valuators agree with this hypothesis, which was extracted by the survey conducted amongst valuators. The final manual on how we arrived at this can be found in Appendix E.

	Calculation/ Financial Parameters					
		Interest Rate	*Costs*	*Income*	*Vacancy Rate*	*Time Frame*
Circular Principles	*Maximize the amount of sustainable bio-based materials*	Green loans (lower interest rates) allotted by banks	Higher investment costs, lower operational costs	Higher savings, thus larger profit, thus higher income		Longer duration of time needed to earn back investments
	Maximize the potential for high-quality reuse			Satisfaction of clients leads to lower vacancy rate, leading to more consistent income	Satisfaction of clients leads to lower vacancy rate, leading to higher valuation	
	Design with minimum amount of materials		Lower costs due to lesser materials to be purchased			
	Minimize the amount of new (virgin) materials	High interest rates lead to lesser amount of components.	Helps investor mitigate risks related to increasing costs of traditional materials (due to scarcity)			
	Design for maximum functional lifetime		Higher investment, but lower costs due to reduced need for relocation, renovation, and repairs	It is possible that higher rents can be asked as the building is capable of completely adjusting to the specific demands of tenants	Ease of adaptability to client requirement leads to lower vacancy rate, leading to higher valuation	Longer duration of time needed to earn back investments
	Design for optimum management and maintenance		Higher investment, but lower costs due to reduced need for relocation,	Adaptability to client requirements implies lower vacancy rate,	Ease of adaptability to client requirement leads to lower vacancy	

			renovation, and repairs	leading to more consistent income	rate, leading to higher valuation	
	Design for multiple lifecycles		Higher investment, but lower costs due to reduced need for relocation, renovation, and repairs	Design and usage for longer duration ensures steady income for a long period of time	Ease of adaptability to client requirement leads to lower vacancy rate, leading to higher valuation	
	Maximize the amount of reused materials	High interest rates lead to lesser amount of components.	Lower costs due to lower materials to be purchased			
To what extent is it agreed upon?		3,90	4,19	4,05	3,86	4,10

Figure 44: Matrix describing how Circular Principles can have an impact on Valuation Parameters

The link between circular principles and valuations that are presented in the analysis is a first start to explore how *Circular Strategies be considered in Real Estate Valuation Practices.* Before this research, there have been methodologies and studies that reinstated the need for circular value, as well as elaborated on various circular business models that could potentially add value. The paper by Arup and Ellen MacArthur Foundation, titled, "From Principles to Practises: Realising the Value of Circular Economy in Real Estate", was a key steppingstone to arriving at this research. The primary difference is that the paper by Arup focused on specific business models of the circular economy, that when applied to building practices, could have an advantage in terms of value. But the scope was limited to those selected circular model strategies. In this research, the focus is on real estate valuation practices, and what the impact of circular principles would be on their fixed parameters of valuation. This provides opportunities for expansion of different case scenarios of circularity, as once they are identified under one or more circular strategies, the impact on the valuation parameter can be easily discovered. Below is a short description of findings related to each link.

While most valuators did see a potential link between most of the circular principles mentioned, the one where they still had their doubts was with respect to the link with interest and vacancy rates. To elucidate on one, from literature as well, the definition and the usage of interest rates for valuation purposes are varied. Usually, an increase in the interest rate means a drop in the property value. But fundamentally, the increase in the interest rate off late is a sign of economic growth, which means that it will lead to higher demand of spaces, higher rents, and will then offset interest rates. Hence while the research has managed to exhibit a good explanation of how interest rates work, the link with circularity has not been so successful yet. Thus, as a further recommendation to the research, it would be valuable to align those connections in order, so that the list presented is then more complete.

With respect to vacancy rate, it did not receive as much consent as the other parameters. But this means that that there is more scope for research in terms of how vacancy rates can be positively impacted by the circular economy. According to the researcher, vacancy rate is a prime parameter for calculating commercial properties using the income method, where the potential income of the building is assessed, to determine what the building should be valued at. A higher vacancy rate determines lower income, leading to a lower valuation of the property. On the other side, circular principles such as adaptability and maximizing the number of life cycles enable the rapidly changing needs for meeting or spaces. Additionally, different tenants require different configurations, and this is where modular and re-organizable components will have an

advantage, leading to shorter 'vacant' periods between two rentals. Furthermore, there can be scenarios where tenants require flexible spaces for their marketing and image, for certain exhibits like 'popup shops' or 'weekly markets'. Here, they would be willing to pay higher for the space, leading to a higher property valuation.

Conversely, other factors such as costs, higher rent/income, as well as time frame have managed to show connections with a few circular design strategies and received majority consent as well.

Another conclusion drawn from this research is that *various companies that are involved in sustainable design are in it because they believe in the need for the transition, as well as their branding and image of the company*. This is at present of higher value to them, as it has the potential to steer the economy. They believe that the demand for sustainable buildings will raise its value until the industry can match up to these demands. At present, no one has visible financial incentives yet. For them, they are aware of ways in which the world is changing and advancing towards, and their priority is to be forerunners in the industry and to be prepared for the government legislations to arrive. They visualize that the future will head towards stronger sustainable principles, and they do not want to fall behind in this transition. Hence, a lot of sustainable as well as circular buildings are made to serve as prototypes for the future. Using these prototypes, financial implications can be sought, and the effect on the value of a property can have substantial proof and backing. They can view the progress live, along with issues faced, which can be addressed and serve as further information for future projects. Thus, even though there are no visible financial benefits yet, they will be available for the future, and the research enables valuators to keep a lookout for circular design strategies that can be implemented.

Additionally, when trying to realize the link between circularity and valuation, we tend to forget that circularity is a component of sustainability, and if treated like that, it makes matters clearer for all stakeholders to comprehend and consider implementing. Each project or industry cannot be 100% circular yet, but it can be strongly sustainable, by applying components of circularity that befit the project. This reduces the pressure and unsureness about implementing something unknown, with a modification in framing the definitions.

With deeper introspection into the main theme and the conclusions drawn from the analysis of each parameter, it was determined that *valuation parameters can be divided into subjective and objective*. Objective means data backed by substantial, tangible proof, whereas subjective considerations rely partially on the perspective of the individual valuating the property. This was an interesting finding upon interacting with experienced valuators in the Netherlands. They emphasized the fact that although they try to make valuations as objective as possible, in the end, it is the signature of the valuator on the report. Hence, his experience and expertise play a role in the evaluation process. The 'subjective' parameters were verified by valuators before establishing connections with circular principles. The description of the links was also verified by several valuators across the Netherlands, and the validity and definitions of the circular principles were discussed and validated by Circular consultants from Copper8, who also have backgrounds varying from Architecture, Sustainability, and Policy making sector. This gives the outcome a higher weightage than it would without their opinions and inputs.

Additionally, because this report is intended for a valuator, it is important to address the implications for them. Although there are no specific skills needed to incorporate the recommended inclusions, it would be easier to incorporate in practice if *valuators are more susceptible to inclusions and are more accepting of them*. The pattern of the focus of valuations changes slightly in terms of more elaborate discussions in the subjective area. Deliberations either among themselves or with clients about how each parameter can be impacted can aid in perceiving the client's opinion of what a 'value' entails, or even what their opinion of the value is. There have been a few instances where investors purchased a circular building at a higher rate than the actual written value, only because they believed that the building had great potential and would reap benefits. This higher value did not show in any financial institutions, but it will impact the way the market sees the value to be.

Although this research is intended for a valuator, *the findings can be useful to developers* as well. The same guidelines would prove beneficial for developers at the design and construction stage of the project since they will have some idea of the implication of circular design strategies on their transactional value post construction. It can serve as an incentive for them to implement circular practices since they will now know that there are possibilities of seeing its worth. The research enables developers with more confidence to take the risk of higher investments due to sustainable and circular practices.

This research also helps in the shift from 'looking back' to older comparables and standards towards a more *'forward' outlook*. The approach with which a property is valued is then more wholesome, keeping in mind the predictions for the future. This was one of the primary reasons the thesis was chosen because all valuators currently look back at similar, already valued properties. The current methods do not account for the changing standards and regulations that the government aims to incorporate. A live case where it came to light that looking back at comparables does not always help is with the onset of COVID-19. It shook the real estate market, and the usually high-demand commercial spaces fell vacant. This eventually reflected in the value as well, but it was not due to any analysis or comparables, but because of the unforeseen scenario. It nudged valuators to see that not all predictions can be perfect, and situations like this bring in some room for amendments.

Finally, as an 'end product' of the entire analysis and research, there is a short manual that has been prepared for Valuators. It briefly discusses about each circular design principles, its impact on different parameters of valuation, an example of each, as well as a simple formula explaining the impact. This would serve as a quick checklist for valuators when new projects come in.

7.3 Limitations of the Research

This research, just like most graduation thesis done, faced certain limitations and setbacks which probably influenced the nature of the outcome. They are elucidated below:

To start with, it is known that the circular economy, because of being relatively new, has various definitions and interpretations. This sometimes makes it vague for the user, as well as may lead to confusion with what the accurate principles of the circular economy are. For the sake of this research, the definition of the circular economy has been elaborated on in the theoretical background, along with the principles that will be considered. Although necessary, this rules out the possibilities of exploring the inclusion of valuation parameters within the broader domain of the circular economy.

The study is exploratory and qualitative, and it is based on the participants' personal experiences. Each interviewee's own experience is biased. To overcome this constraint, many interviews with real estate professionals were undertaken, and their observations were cross-checked against other sources such as documents, web information, or even Copper8 employees. Furthermore, the researcher's analytical and design skills influence the conclusions. It is possible that if the study had been taken on by someone with a different background than the current one, the results would have been different.

This research provides an exploration of how valuators can assess circular design strategies within their current list of parameters considered. Since this largely depends upon the interpretation of valuators, the guidelines explored might not carry forward with the same intention of the researcher. Thus, since this is an exploratory research, the connections provided are mere directions that the valuator can take or use as a basis to advance further in the domain of circular valuations. The examples and scenarios mentioned are not restricted to be followed as is but are there to enable valuators, as well as developers and investors to recognize the possibilities of a change in value.

With the limited timeline of the thesis, it was not possible to test the connections on live cases. The testing may have provided useful feedback on how it could be improved and iterated for practice, which could be considered a limitation.

Concerning the methodology chosen, the Delphi Technique came with its set of drawbacks. Probably the most prominent one is the number of iterations followed. The research design consisted of two iterations of the analysis. There is a possibility that more rounds would generate slightly different results. They can be positive or negative. There would be chances of more accuracy, but at the same time, the interest and level of participation of interviewees could have reduced.

7.4 Recommendations for further Research

Given the time and resources available, the research appropriately addressed the scope of applying circular strategies in real estate appraisal practices. The restrictions listed in section 7.3 are utilized as a springboard for future research proposals. Furthermore, given the wide range of both circular principles and valuation techniques, this study serves as a platform for future studies connecting the two areas. This has been elaborated on below.

- The results of the validation session indicated interesting pointers with respect to what is missing and what can be included within the parameters, as well as the link with circular principles. It would be nice to work on those to arrive at a more comprehensive set of results after working on the feedback and recommendations provided.
- The next recommendation would be to consider carrying out action-based research to substantiate the strategies mentioned here. This was an exploration, and although the recommended strategies have been verified, applying them in practical scenarios is different. Hence, to start with, case studies of circular buildings can be taken up by valuators to assess how circular principles will impact their valuation report.
- Since the research tries to find a financial value for circularity, conducting a financial study concerning calculating DCF's for the additional constraints in the parameters would provide clear implications. Hence, a quantitative study of the exact impact of the circular parameters can provide a good basis for developers and investors to see the implications. Valuators would also get a better vision of how it is incorporated, since they may not have a background in circularity.
- The strategies suggested might require certain workshops for valuators, to evaluate properties with an open mind, as well as having basic knowledge of the possible circular strategies. This will enable them to recognize such buildings easier, as well as know-how to tackle them in their calculations.
- A strong recommendation would be to conduct an in-depth study about the policies of the government pertaining to circularity and its implications on the value, to then make recommendations to them. The research discovered various interesting recommendations for the government to introduce as regulations for sustainability. To have those communicated to the municipal bodies would encourage faster change dynamics. Strict government rules regulating stakeholder recommendations in every sector can help to increase the use of the circular economy.

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9 Appendix

9.1 Appendix A

9.1.1 Introduction

9.1.1.1 Introduction of the interviewer

- Second year of Masters in Construction Management and Engineering, TU Delft

- Started my graduation assignment in collaboration with Copper8 and TU Delft in January 2021.

- Research interest – Sustainability/ Circularity/ Real Estate and its Valuation practices. Exploratory research to determine the influence of circular principles in property value.

9.1.1.2 Research objective

This is an exploratory research, and the prime objective is to realize how the Real Estate sector can incorporate Circularity within their existing framework, specifically within the valuation of real estate properties.

9.1.1.3 Purpose of the interview

Interviews are planned to get a practical perspective on all the theoretical investigations done. Semi-structured interviews will be conducted with professionals for a market-based perspective of circular activities as well as real estate practices and how they can be implemented in a way that they reflect the value of the property.

9.1.1.4 Confidentiality of the interview

Before the interview starts, I would like to address few points.

1. How would you like to be mentioned during reporting?
   o Name, function, organization
   o Only function and organization
   o Anonymous
   o Otherwise

2. Is it okay to record this interview as the analysis will be based on the interview? However, a summary of the interview will be sent to be reviewed by you within one week.
   o Yes
   o No
   o Any objections

3. As mentioned, the summary of the interview will be sent to you via email with a week. In case I don't hear back within a time frame of two weeks, I have the consent to use the document for my research. Do you agree with this?
   o Yes
   o No
   o Any objections

9.1.2 Interview structure

Based on the objective, the interview questions will be divided into two parts. The first part will focus on the general introduction and circular economy in the real world. Second- Discussion of the current scenario of the real estate valuation/development/investment sector. Third- More specifics about the circular interventions that can apply to traditional practices and barriers and recommendations for the same.

9.1.3 Semi-structured interview questions

General Questions:

1. Could you describe the company that you work for in terms of its name, industry and function?
2. What is your position/role in the company?
3. For how long have you worked in this role?
4. What is your company's perspective on the Circular Economy?

Questions for Real Estate Valuators

1. What type of valuation methodologies are most used by you?
2. What is the type of Valuation your company carries out (financial / investment, tax calculations, etc.) and who are your primary clients?
3. When you conduct a valuation, what are the most important parameters that account for property valuation? (Environmental impacts, the design and configuration of the building, the construction materials and services, location, and accessibility, fiscal and legislative, management and leasing, social). What do you think will help in increasing the value of a property?
4. How easy/difficult do you think it is to translate circular ideas into practice?
5. Do you have clients who ask of such services yet (what is the demand for inclusions of sustainable aspects)?
6. What is the average vacancy rate for commercial projects? Do you think adaptable properties will help reduce this?
7. Are all the methods to calculate a value still fit for purpose or do you think they are outdated?
8. Do you know of any government policies that align with this task/ or, do you see any inhibitions due to certain government policies that restrict circularity/ sustainability in terms of translating them into concrete values?
9. Do you think including circular values will provide biased results in any way?

Questions for Real Estate Investors

1. What is the main reason of your investments in properties?
2. To what extent of the design/layout/fit-out of the building would the investor like to be involved? How flexible are you with such decisions?
3. According to you, what factors account for 'value' in a property, and what will help increase the value of it?
4. What kind of stakeholders are you directly involved with for a particular business? (banks/Circular consultants/ developers/ contractors/ future users, etc.)
5. How important is collaboration with them?
6. How dependent are you on them? Is there an order or hierarchy of how a process works? (with respect to stakeholders)
7. Is there enough transparency between you all?
8. How hard is it to convince clients to initiate circular practices?
9. What according to you are your primary goals as RE investing company/ individual?
10. How much do you know of the Circular economy, its benefits and how it can be incorporated?
11. How often to clients/ tenants ask for such developments in a property?
12. How involved are you with the general practices of your tenants (in terms of energy consumption and sustainability)?
13. How important is it for you to 'own' the products/service/component that are a part of your property? What is your take on a Product as a service model?
14. Would it impact the valuation of the project in any way?
15. To what extent do you import materials for projects? (A ratio between imported vs local?)
16. To what extent would you consider using secondhand components in your buildings? How do you think this would impact your lease rates/ property saleable value? What barriers would you face?

17. Would you be involved/ interested in taking back materials (for reuse) from the building once the project is completed? What logistics issues do you think you would face?
18. What happens to the building at the end of the lifespan? Are you involved until that moment?
19. What is the average vacancy rate for commercial projects? Do you think adaptable properties will help reduce this?
20. Do you think you have easy access to the required resources/knowledge to implement a circular outlook?
21. What according to you, are the reasons for non-inclusion of circularity in this field?
22. What kind of risks do you foresee if you include Circularity in your practice?
23. How do you finance most of your projects? How susceptible are you to Private financing?
24. How easy/difficult is it to secure a bank loan for an investment? Do you think circular motives account for easier loan sanctions in any way?
25. How different would the flow of money be for you if circular practices were adopted?
26. What do you think would be the impact on the cash-flow stream if you shifted to adopting a Product-as-a-service model?
27. Do you get any form of tax exemptions/incentives for using energy efficient resources and practices?
28. Do you see any government incentives/policies in place that aid with circularity?

Questions for Banks

1. How would you define your relationship with the Real Estate Industry?
2. How often do you have clients that borrow money for new construction projects? What is the average Loan-to-Value Ratio you consider?
3. Are you involved in the valuation process of properties? If yes, what parameters are considered that account for high value?
4. How do banks currently depreciate the value of properties? Do you account for any residual values?
5. What stakeholders in the Real estate industry do you have most interaction with? Would you prefer more interaction down the chain or is a one-point contact easier?
6. Do you have adequate information about Netherlands Circular Ambitions, and are you aware of how banks can play a role in it?
7. Do you consider financing circular projects as riskier than regular ones? If yes, what do you think are the risks associated?
8. Will banks be willing to sanction loans easier if they knew of the benefits of circular buildings, even though they might need a higher initial investment?
9. How different would the cash flows and financing be in a circular context?
10. How compliant are you to provide other services to circular projects, apart from financing?
11. Risk assessment services
12. Platform for information and transferring of demand for loans to private third parties.
13. Capitalization on the trust factor banks have- to be an ambassador in terms of propagating new properties (circular) to potential clients.
14. Would you be willing to finance an adaptable building- one whose end function might not be clear to you in the beginning?
15. How open is the idea of internal training programs to understand and eventually implement investments in circular business models?
16. Introduction of green, sustainable and CE related bonds?

Questions for Circular Consultants

1. What is your role/ specialty in the organization?
2. Do you see the issue of loss of value on all your building related projects?
3. What factors of a building do you think are missing value (circularity related) and can be incorporated?
4. What do you think are the major barriers to this issue?

5. What is your opinion about the different stakeholders involved? Since in circularity collaboration is so important, who must be the initiator here in the RE industry?
6. Where do circular consultants come in the picture here?
7. To what extent/ how firm can your opinions (consultancy) be towards clients?
8. Do you think a circular consultancy can start workshops to educate valuators on how to value it? E.g., I got a question, what is the difference between a regular wall and a “circular wall”?
9. Would you (or your company) choose to go out of your way to encourage stakeholders in a particular industry to adopt circular practices?
10. How difficult do you think it is to convince investors/ developers to incorporate these initiatives in their projects?
11. Since valuation is an age-old practice and has been following one method of referring to previous data, in what aspects can we add on/modify that?
12. How easy/difficult do you think it is to finance such projects? Are they riskier, how?
13. Do you know of any government incentives for circular design practices?
14. Are there any policies you wish were implemented to facilitate transition?
15. To what extent would all these interventions add value to a property?
16. Methods such as wearthie taxatie and residual value calculator calculate the lowest possible value of a material at the end of life. What other factors of circularity do you see up the value chain?
17. Currently, how do you measure circularity? (Specifically in the built environment)
18. First steps forward to tackle this gap in actual vs predicted value.
19. How do we tackle the mismatch of economic lifetime vs actual lifetime of building components?

9.2 Appendix B

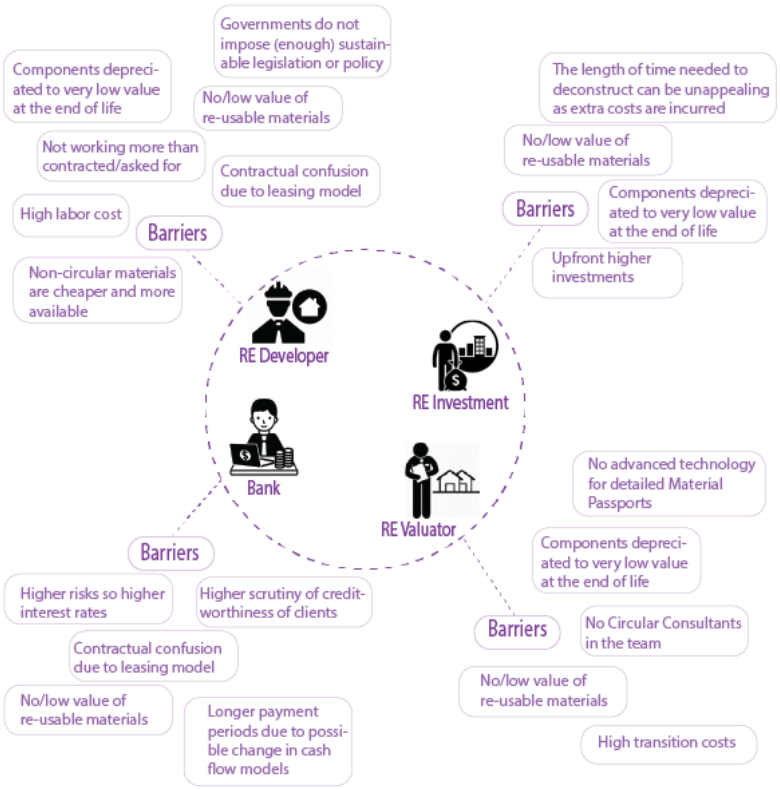


Figure 45: Barriers faced by Primary Stakeholders; obtained from interviews and literature

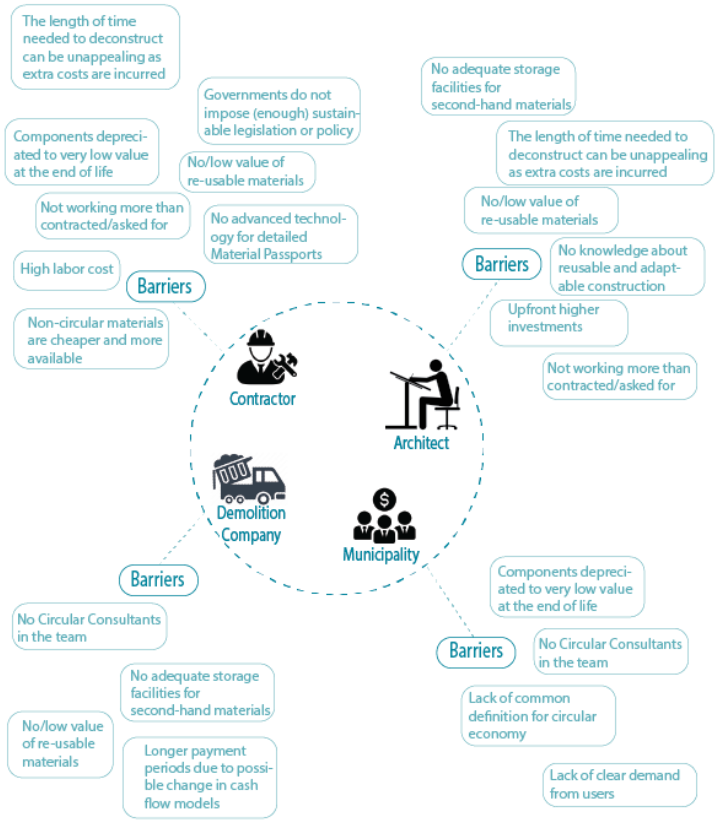


Figure 46: Barriers faced by Secondary Stakeholders- obtained from literature

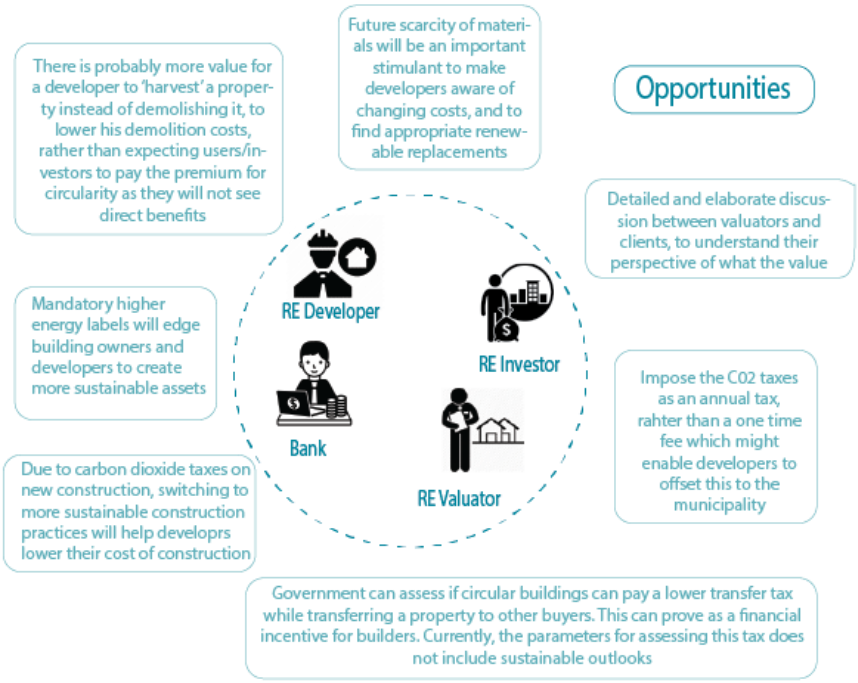


Figure 47: Opportunities for Circular Value as seen via interviews

9.3 Appendix C

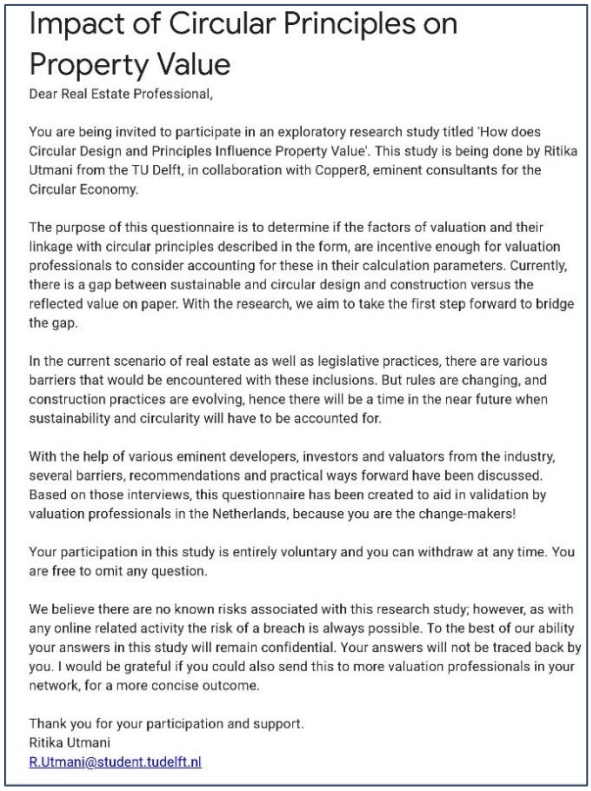
THEME	DESCRIPTION	HIGHLIGHTED QUOTES
LEGISLATIVE BARRIER	Product as a service model: If in a circular building there are components that have been leased out, and not owned by the developer/ investor which must be returned at the end of the lifecycle, then as a valuator, when you look at a leased item, you ideally account for it as added costs for the project, and not an added value/ asset for a building. This defeats the financial purpose of not buying the product. Due to future legislation by the government, every project will eventually require sustainable aspects. The usage of sustainable materials will become obligatory and standard. Will it then have extra value or a new standard value?	"To orchestrate a change, there needs to be an impact on taxation and/or finance. Currently, there are neither of these that serve as bold reasons to transition to circularity." "Subsidies from the government can be misleading. Probably then the reason for the demand of a particular asset is due to the subsidy, and this does not reflect the actual market value/demand for it."
FINANCIAL BARRIER	The exit value when you have reusable building materials is negligent in comparison to the cash flows. An investor requires a return on investment, and they will try to re-lend the property for as long as they find new tenants. If they find a new tenant for 10 additional years beyond the stipulated lifetime, who pays half the rent, the building will still be leased out, instead of being demolished as its economic lifetime is over. The additional harvest then received after the extra 10 years is still unclear. The current period of a DCF for valuation of properties is usually 15 years, which is a bare minimum. It is not enough to see the benefits of being a flexible property since usually, a tenant retains usage for the property for that amount of time. Hence, it does not make an impact if the property is flexible as benefits of it are not seen within 15 years.	"There is probably a very small profit that can be attained with circular interventions currently, but there is no effect on cash flows during exploration for the current investor. For an investment of millions, they probably got 2000-3000 for the materials, which is insignificant." "Banks have a sustainable value parameter with a much lower percentage than the market, to offset their risks. There is some progress with respect to it, but very slow."
TECHNICAL BARRIER	To be able to include circular components within the existing methods of valuation, circular buildings that are already constructed must be able to prove if they are truly circular and there are possibilities to dismantle and rebuild elsewhere while retaining/maximizing value. There is no proof yet.	"There is a possibility that harvested materials might not be technically sound enough for the future because technology evolves so fast. Hence, what is circular right now, will it still be circular 50-60 years from now?"
	Various new bio-based materials, although created and tested in labs, do not fit into the government database of approved materials yet. This causes a barrier for interested parties to invest in and include them in their projects.	"There is no concrete definition for the circular economy, hence it is challenging to steer an entire project towards a vague concept."

ORGANIZATIONAL BARRIER	With respect to flexibility in the portability of buildings, there are a few key issues: ○ The second location is undefined at the beginning of the project. For an investor, he would feel the need to earn back all his investment in the first phase/location of the project, even though its lifetime could be way longer. ○ There is a possibility that the value of the building in the first location goes down to zero once it has been shifted, due to a change in legislation. This is a risk the investor would be apprehensive to take. ○ If a property lifespan has been defined for a shorter period (say 15 years), its value is already deemed to be lower in the first set of calculations. Also, there is not enough clarity with respect to what to do with the remaining materials after 15years.	"The benefits of implementing circular principles in buildings will not be seen directly by the user. It is more on a long-term basis for the investor and related to societal value." "The willingness of valuators to look more in the future along with past comparables as well is one of the largest challenges. Once that mindset evolves, the transition will be smoother." "Since the Circular Economy demands a change in the way transactions are carried out, leading to longer durations of transactions, the risk that comes with it also increases. This calls for more thorough scrutiny of the creditworthiness profile of a customer."

Table 10: Barriers as observed by Interviewees

9.4 Appendix D

Survey Conducted as part of Delphi Methodology part 2. The below provided clips were circulated as a form amongst RE Valuators to get their opinion and consent.



Impact of Circular Principles on Property Value

Dear Real Estate Professional,

You are being invited to participate in an exploratory research study titled 'How does Circular Design and Principles Influence Property Value'. This study is being done by Ritika Utmani from the TU Delft, in collaboration with Copper8, eminent consultants for the Circular Economy.

The purpose of this questionnaire is to determine if the factors of valuation and their linkage with circular principles described in the form, are incentive enough for valuation professionals to consider accounting for these in their calculation parameters. Currently, there is a gap between sustainable and circular design and construction versus the reflected value on paper. With the research, we aim to take the first step forward to bridge the gap.

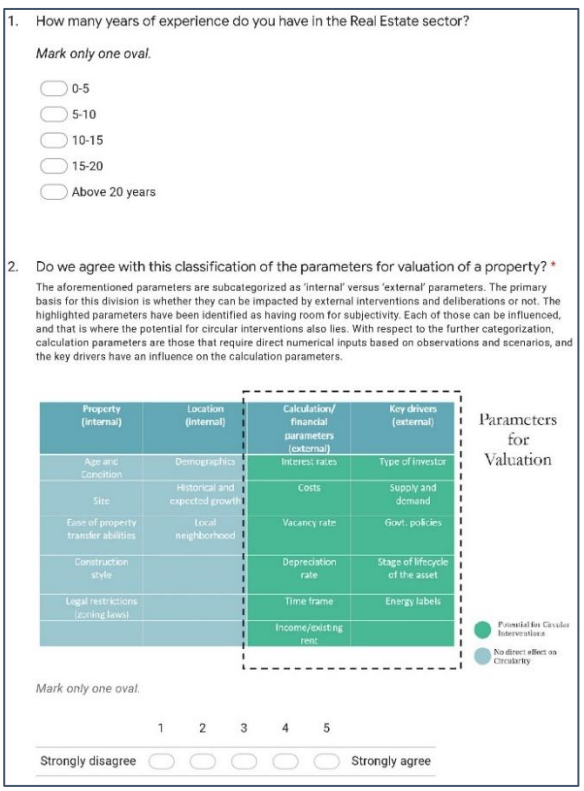
In the current scenario of real estate as well as legislative practices, there are various barriers that would be encountered with these inclusions. But rules are changing, and construction practices are evolving, hence there will be a time in the near future when sustainability and circularity will have to be accounted for.

With the help of various eminent developers, investors and valuators from the industry, several barriers, recommendations and practical ways forward have been discussed. Based on those interviews, this questionnaire has been created to aid in validation by valuation professionals in the Netherlands, because you are the change-makers!

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any question.

We believe there are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. Your answers will not be traced back by you. I would be grateful if you could also send this to more valuation professionals in your network, for a more concise outcome.

Thank you for your participation and support.
Ritika Utmani
R.Utmani@student.tudelft.nl



1. How many years of experience do you have in the Real Estate sector?

Mark only one oval.

- 0-5
- 5-10
- 10-15
- 15-20
- Above 20 years

2. Do we agree with this classification of the parameters for valuation of a property? *

The aforementioned parameters are subcategorized as 'internal' versus 'external' parameters. The primary basis for this division is whether they can be impacted by external interventions and deliberations or not. The highlighted parameters have been identified as having room for subjectivity. Each of those can be influenced, and that is where the potential for circular interventions also lies. With respect to the further categorization, calculation parameters are those that require direct numerical inputs based on observations and scenarios, and the key drivers have an influence on the calculation parameters.

Property (internal)	Location (internal)	Calculation/ financial parameters (external)	Key drivers (external)
Age and Condition	Demographics	Interest rates	Type of investor
Size	Historical and expected growth	Costs	Supply and demand
Ease of property transfer abilities	Local neighborhood	Vacancy rate	Govt. policies
Construction style		Depreciation rate	Stage of lifecycle of the asset
Legal restrictions (zoning laws)		Time frame	Energy labels
		Income/existing rent	

Parameters for Valuation

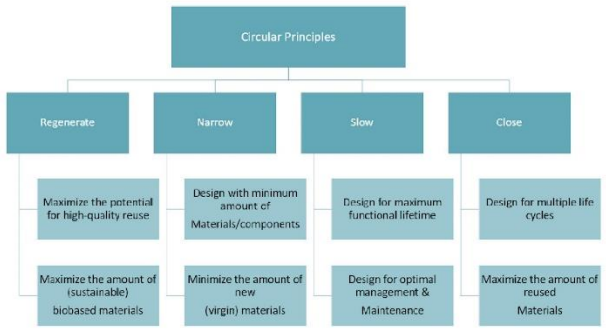
Potential for Circular Interventions
No direct effect on Circularity

Mark only one oval.

	1	2	3	4	5	
Strongly disagree						Strongly agree

3. If no, is there anything in your opinion that is missing?

4. Here is a short background of the circular principles that the valuation parameters are linked with. Do you see potential in translating these into calculation parameters? *



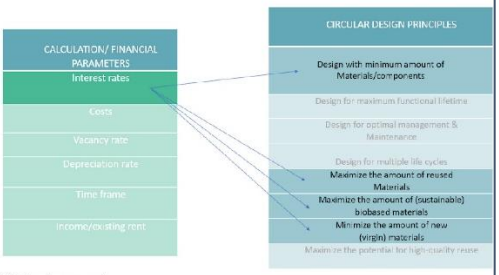
Mark only one oval.

- Yes
- No
- Maybe

5. Here are some examples of how each of these principles can be put into perspective

Parameter - Interest Rate

6. Here is the association between 'interest rates' and Circular Principles for your reference *



Mark only one oval.

- There is potential here
- I do not see the link yet

7. To what extent is this explanation feasible, according to you? *

IMPACT ON VALUATION PARAMETER — Interest Rate

- *Higher interest rates* tend to *raise the cost of construction*, which leads to fewer products being developed. In such a case, it makes sense to apply the principle of using minimum amount of materials in construction. Even sharing resources can help offset the loss due to higher interest rate.
- Conversely, there are various banks that are transforming towards providing green or impact loans and *attractive interest rates towards circular practices*. For example, developers seeking BREAM certificates in their projects should be able to get a discounted interest rate. Hence, a change in interest rate can have a direct impact on the value of a property.
- With respect to value of properties, it is known that *when interest rates rise, property values fall* because of lower yields due to the increased cost of financing. Thus, with the above-mentioned circular practices that enable savings, we can avoid (or reduce) the loss of property value.

FORMULA

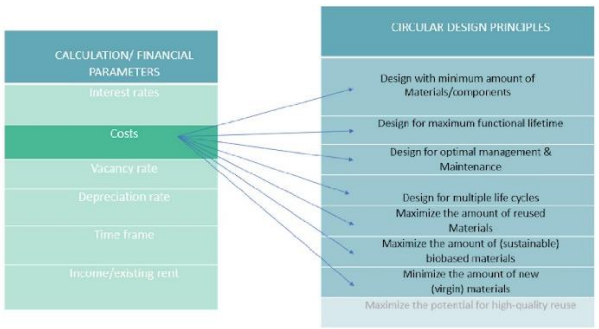
(-)Higher investment costs (+) lower maintenance costs (+) higher residual value

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

8. Would you like to highlight a short justification for the same?

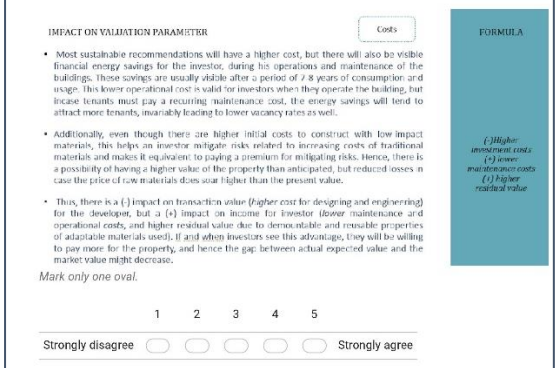
9. Here is the association between 'cost' and Circular Principles for your reference *



Mark only one oval.

- There is potential here
- I do not see a link yet

10. To what extent is this explanation feasible, according to you? *

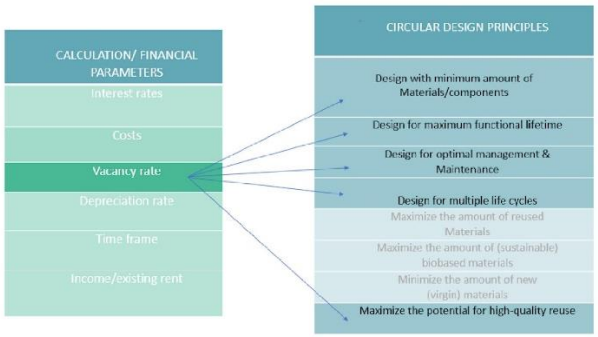


Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

11. Would you like to highlight a short justification for the same?

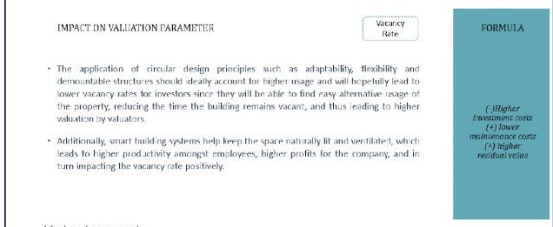
12. Here is the association between 'Vacancy rates' and Circular Principles for your reference *



Mark only one oval.

◯ There is potential here
◯ I do not see a link yet

13. To what extent is this explanation feasible, according to you? *

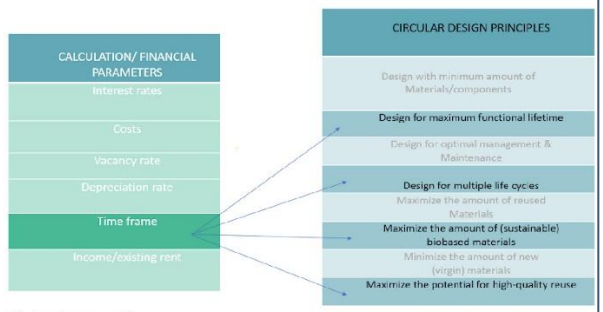


Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

14. Would you like to highlight a short justification for the same?

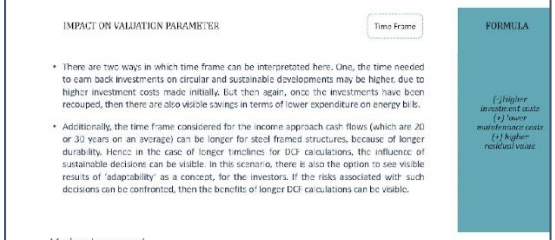
15. Here is the association between 'Time frame' and Circular Principles for your reference *



Mark only one oval.

◯ I see potential here
◯ I do not see a link yet

16. To what extent is this explanation feasible, according to you? *

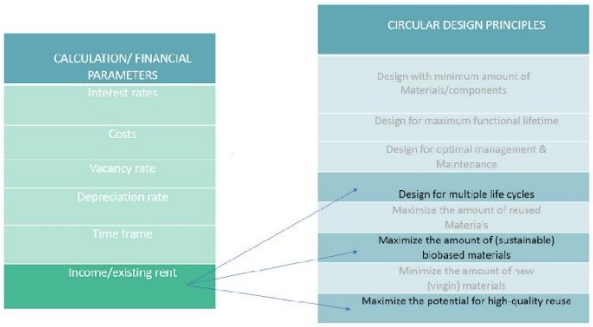


Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

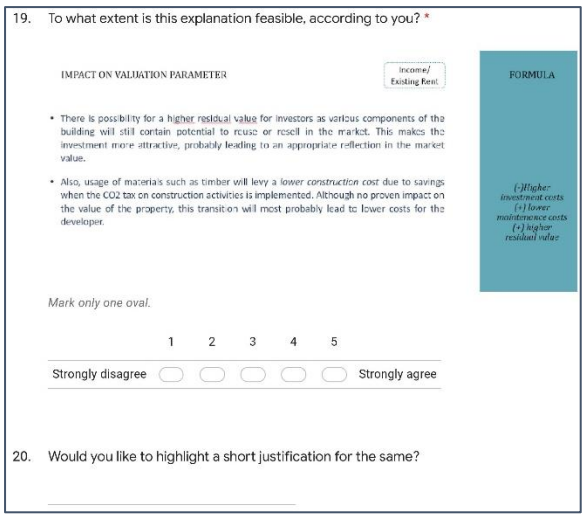
17. Would you like to highlight a short justification for the same?

18. Here is the association between 'Income' and Circular Principles for your reference *



Mark only one oval.

◯ I see potential here
◯ I do not see a link yet



19. To what extent is this explanation feasible, according to you? *

IMPACT ON VALUATION PARAMETER | Income/ Existing Rent | FORMULA

- There is possibility for a higher residual value for investors as various components of the building will still contain potential to reuse or resell in the market. This makes the investment more attractive, probably leading to an appropriate reflection in the market value.
- Also, usage of materials such as timber will levy a *lower construction cost* due to savings when the CO2 tax on construction activities is implemented. Although no proven impact on the value of the property, this transition will most probably lead to lower costs for the developer.

(-)Higher investment costs (+) lower maintenance costs (+) higher residual value

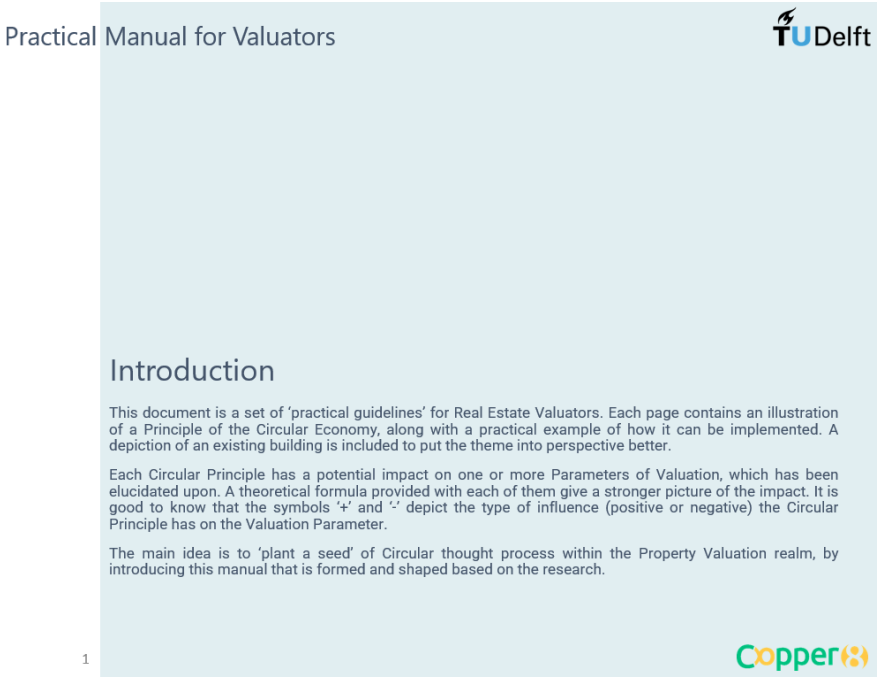
Mark only one oval.

	1	2	3	4	5	
Strongly disagree	◯	◯	◯	◯	◯	Strongly agree

20. Would you like to highlight a short justification for the same?

9.5 Appendix E

The final 'product' consists of a manual for RE Valuators, which (upon completing further recommendations) they can refer to, as a basis for understanding the connection of Circularity with their practice.



Practical Manual for Valuators

TU Delft

Introduction

This document is a set of 'practical guidelines' for Real Estate Valuators. Each page contains an illustration of a Principle of the Circular Economy, along with a practical example of how it can be implemented. A depiction of an existing building is included to put the theme into perspective better.

Each Circular Principle has a potential impact on one or more Parameters of Valuation, which has been elucidated upon. A theoretical formula provided with each of them give a stronger picture of the impact. It is good to know that the symbols '+' and '-' depict the type of influence (positive or negative) the Circular Principle has on the Valuation Parameter.

The main idea is to 'plant a seed' of Circular thought process within the Property Valuation realm, by introducing this manual that is formed and shaped based on the research.

1

Copper8

Circular Principle

Maximize the amount of Sustainable (Bio-Based Materials)

TU Delft

Description

A method of preventing the use of new virgin materials that are finite, is by using biobased materials. Biobased materials are materials that grow in nature, such as hemp and wood. In theory, they materials can be used endlessly. Another benefit of biobased materials is the fact that during their growth process, they take up CO_2 from the air, leading to a low carbon footprint.

Case Example : The Neobuild Innovation Centre (NIC), Luxemburg

The Newbuild Innovation Centre (NIC) uses solid wood, cellulose, cement particle board, stone aggregates, wooden cladding and 100% bio-based paint, which serves as an apt example for such buildings.

Impact on Valuation Parameter

Interest Rate

By upscaling usage of sustainable materials in construction projects, there is a direct impact on the savings due to impact/green loans (lower interest rates) levied by banks, for sustainable construction. A lower interest rate leads to overall lower construction costs in the cash flows, allowing for higher profits and income obtained by developers, provided the other aspects are the same. Higher profit can lead to higher income and thus potential for high market value.

Income

(+)Lower interest rates = (+) higher savings and profit

(+)Higher profits = (+) potential higher market value

Cost

On the other hand, it should be known that there is a possibility of higher initial costs for developers since sustainable materials are not produced in the market in bulk yet and buying them in small quantities turn out more expensive than high usage non-renewable materials.

(-) Higher investment costs =(-) potential lower market value

Time Frame

Because sustainable materials are more expensive currently, it will take a longer duration to earn back higher investments as compared to cash flows predicted for non-sustainable materials, making it riskier to invest.

(-) Longer recovery period =(-) higher risk

https://renewable-carbon.eu/news/neobuild-innovation-centre-living-lab-of-construction-technology-solutions/

2

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Circular Principle

Maximize the potential for high quality reuse

TU Delft

Description

Reuse of components implies that there is lesser extraction and use of new materials, leading to advantages for the developer, as well as investors. When materials are reused, it is important that they are safe for it. When solely focussing on reusing materials, there is risk of reusing toxic materials, while you would rather not reuse them at all. Cradle2Cradle made a list of chemicals which entails materials that should not be used in buildings.

Case Example : Stadskantoor Venlo

Stadskantoor Venlo is a municipal building in Venlo, where Cradle2Cradle materials have been used. A research conducted two years later concluded that the building lead to less sickness among employees and higher productivity, leading up to almost €200K lower costs every year.

Impact on Valuation Parameter

Income

The most important aspect of maximizing the potential for high quality reuse of materials is to ensure a minimum amount of toxic and hazardous materials are being used. The 'cleaner' the materials are, the higher the potential for high quality reuse there is, resulting in a higher residual value, thus in a higher market value.

(+) Higher residual value = (+) higher market value

An indirect effect of this principle could be that 'healthy' buildings will be created. Healthy buildings have proved to lower the sickness of employees and increase productivity. This could have potential for increasing the rent of these healthy buildings, thus resulting in a higher market value.

(+) Higher income = (+) higher market value

Vacancy Rate

There is potential for increased productivity to translate to satisfied tenants, meaning lower vacancy rate, resulting in high demand and potentially higher market values.

(+) Lower vacancy rate = (+) higher income = (+) higher market value

https://www.c2cexpolab.eu/referenties/stadskantoor-venlo/

3

Copper8

Circular Principle

Minimize the amount of New (virgin) Materials

TU Delft

Description

The central goal of circularity is to minimize, and eventually stop the use of virgin materials, as they are not infinite. This principle focuses solely on minimizing the amount of virgin materials. There is a possibility that in order to minimize the amount of virgin materials, more secondary or biobased materials are required.

Case Example : Gemeentehuis Brummen, Brummen

To minimize the amount of new (virgin) materials, wooden beams and columns were used instead of traditional steel beams and columns in the example above. In this case they intentionally oversized the structure for future reuse potential. This is possible within the principle of minimizing the amount of new (virgin) materials, and not if the total use of materials is to be minimized.

Impact on Valuation Parameter

Cost

Depending on the way the amount of new (virgin) materials are minimized it could either mean higher or lower building costs. In the current situation biobased and secondary materials are often more expensive than new virgin materials. This is due to the mass production of new virgin materials, leading to a lower unit price. It may be the case where higher costs can lead to lower market value determined, but there is potential to explore further in that area.

(-) Higher investment costs, while benefits stay the same = (-) potential lower market value

Minimizing the amount of new (virgin) materials could also be obtained by optimizing the design. In this case the total amount of materials used is reduced, leading to lower building costs and thus a higher market value calculated for the building.

(+) Lower investment costs, while benefits stay the same = (+) higher market value

https://www.rau.eu/portfolio/gemeentehuis-brummen/

4

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Circular Principle

Design with minimum amount of materials/components

TU Delft

Description

Designing with a minimum amount of materials and components is similar, yet different from minimizing the use of virgin materials. With this circular principle the focus is to minimize the total amount of used materials (see Figure). This can be achieved by optimizing the design by using tools for topological optimizations.

Case Example : Alliander Duiven, Duiven

The atrium was constructed with steel and the designer intended to minimize the use of steel to lower the carbon footprint. Instead of procuring from regular steel suppliers, they went to a supplier of rollercoasters on fairs, since they use demountable and light weight sections. For Alliander Duiven this lead to an optimized and light weight steel structure, which minimized the use of steel by around 30%.

Impact on Valuation Parameter

Cost

Less material consumption implies lower costs for purchasing, which can lead to higher savings and thus higher profits. In this case, the total amount of materials used is minimized, leading to lower building costs.

Ideally, here, there should be potential for a higher market value of the building because of higher profits. But it must be noted that higher profits for the developer might not always translate as higher income for the property owner. The developer might attain a higher transaction value when selling to the investor, but this need not translate into a different market value.

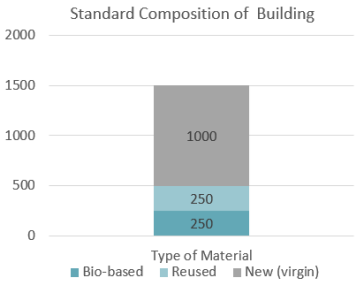
(+) Lower investment costs, while benefits stay the same = (+) higher profits = (+) potential higher market value

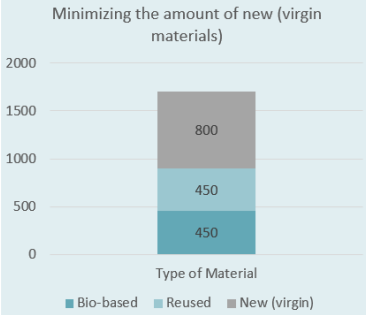
Thomas Rau: https://www.vpro.nl/programmas/tegenlicht/kijk/afleveringen/2015-2016/einde-van-bezit.html

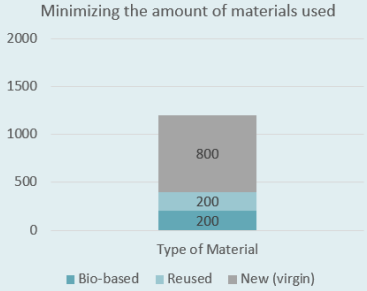
5

Copper8

Variances between the two categories







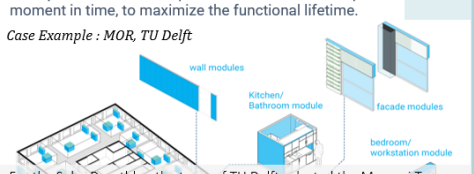
6

Circular Principle — Design for Maximum Functional Lifetime (adaptable buildings)

Description

The most circular building is one that is used in the same location endlessly, like the canal houses in Amsterdam which have been used as warehouses, stores, offices and residents. Until now the inside of those buildings has been altered and adapted to the functional need of the time, while the structure and skin of the building remained intact. It is crucial to design a building that is not optimized for one specific function at one specific moment in time, to maximize the functional lifetime.

Case Example : MOR, TU Delft



For the Solar Decathlon the team of TU Delft selected the Marconi Torens in Rotterdam as a case, which were three former office buildings that turned obsolete. The team redesigned the office towers into residents, with a focus on adaptability. This lead to modular buildings where the houses can be altered to ensure a maximum functional lifetime.

Buildings need to have a robust structure (and possibly skin), while the other shearing layers (services, space plan and possibly skin) can be changed easily. Standardization of measurements, demountable connections and modularity are key factors in designing a building for a maximum functional lifetime.

Impact on Valuation Parameter

Vacancy Rate

Due to ease of long-term adaptability to client requirements, buildings are occupied for longer durations and contain high demand. Whenever the functional need changes, or even when a specific function isn't needed anymore, these kind of buildings can easily adapt while minimizing the construction time. This leads to lower vacancy rates during the exploitation phase, thus a higher market value.

(+) Lower vacancy rate = (+) higher income = (+) higher market value

Cost

To design a building that isn't optimized for a specific function, often there needs to be some sort of oversizing. This could possibly lead to higher building costs. It may be the case where higher costs directly lead to lower market value determined, but there is potential to explore further in that area.

(-) Higher investment costs = (-) possibly lower market value

Since these types of buildings can be easily adapted to different functional needs, the transformation costs are lower than traditional buildings. Here as well, higher savings lead to higher profits, but this translates to higher income, meaning the property value would be calculated to be higher, because of new potentially higher income.

(+) Lower transformation costs = (+) possibly higher market value

Income

Because the building is adaptable, it is possible that higher rents can be asked as the building is capable of completely adjusting to the specific demands of tenants.

(+) Higher income = (+) higher market value

Time Frame

Because sustainable materials are more expensive currently, it will take a longer duration to earn back higher investments as compared to cash flows predicted for non-sustainable materials, making it riskier to invest.

(-) Longer recovery period =(-) higher risk

7

Circular Principle — Design for Optimal Management and Maintenance

Description

Operation, Maintenance, and Repair Costs are greater than three times the cost of initial construction. Having such a profound impact, it is important that operations and maintenance considerations are discussed at the beginning of construction to optimize the life-cycle of a building.

Usage of automated systems like the Building Management Systems is one way to optimize. An example is the Edge, at Amsterdam. It integrates numerous smart technologies to create adaptable and intelligent workspaces. It demonstrates that a collaborative working environment can be combined successfully with achieving the highest levels of sustainability.

Impact on Valuation Parameter

Vacancy Rate

If a building is designed for optimal management and maintenance, it means that it is designed in a way that less maintenance is required (less impact, both financially and ecologically), leading to less disturbance to the tenants. This could potentially mean that due to high demand and satisfied tenants the vacancy rate goes down, as there are fewer activities during the operational phase. A lower vacancy rate leads to higher income, thus a higher transaction and market value.

(+) Lower vacancy rate = (+) higher income = (+) higher market value

Cost

A higher initial higher investment for developers to design and construct such structures, can lead to visible lower costs for investors/users in terms of less effort, time and money used for relocation, renovation, maintenance, and repairs. The costs during operations go down, leading to higher savings (thus income) and a potentially higher market value.

(+) lower maintenance costs and (+) lower operation costs = (+) potential higher market value

https://www.bloomberg.com/features/2015-the-edge-the-worlds-greenest-building/
https://www.wbdg.org/resources/design-for-maintainability

8

Circular Principle — Design for Multiple Lifecycles

Description

Whenever a building cannot stay at the same location, it should be reused in the most valuable way. In order of preference, reusing the building entirely, at a new location, reusing the components of a building (entire façade) in new buildings, reusing the products of a building (windows) in new buildings and lastly, reusing the materials in new buildings can be considered. In order to reuse in the most valuable way, it is important to design in a way that products can be easily demounted.

The temporary courthouse in Amsterdam is designed to be at that location for just 5 years, while the new permanent courthouse is realised. The building is made in a way that everything is demountable and reusable. Most of the building will be relocated to a new location in Enschede, where the building is reused as a whole.

Impact on Valuation Parameter

Cost

There can be potentially higher investment for developers to design and construct such structures.

(-) Higher initial building costs

Having a demountable building can lead to lower costs for investors/users in terms of less effort, time and money used for 'demolition' or relocation, especially when it is known beforehand that the building will be temporary, like for example, many student houses being built in the Netherlands.

(+)Lower 'demolition' costs = (+) higher market value

Vacancy Rate

Due to lesser time take to adapt to client requirements, buildings are occupied for longer durations and contain high demand. Because of this demand and potentially satisfied tenants, the vacancy rate can be lower, leading to a higher market valuation.

(+) Lower vacancy rate = (+) higher income = (+) higher market value

Income

When a building is completely demountable, the reuse potential is significantly higher. This could lead to a higher residual value for the building when it will be demounted, leading to profits and a potential higher transactional value when it is resold.

Higher residual value (+)

https://www.metropolismag.com/architecture/adaptive-reuse-2020/pic/105037/

9

Circular Principle

Maximize the amount of Reused Materials

TU Delft

Description

Buildings can be constructed with either new (virgin) materials or secondary reused materials. Building with reused materials has two benefits, it has a lower carbon footprint, and it prevents extraction of finite resources from the earth.

Case Example : Sports Facility, Wageningen

For the new Sports Facility in Wageningen reusing materials in the new building was one of the focus points. A number of materials have been reused throughout the building, such as steel beams, wooden slabs, insulation, etc.

Within the principle of reusing materials there are different levels of reuse (refer to figure of Value Hill). It is preferred to reuse materials with the highest value, which is as follows:
-Reuse of components (e.g., entire façade)
-Reuse of products (e.g., window as a whole)
-Reuse of materials (e.g., wood out of window frame)

Impact on Valuation Parameter

Interest Rates

More banks are offering 'green loans' with lower interest rates than regular loans. When it can be proved that a building has a significant amount of reused materials, there is potential for a green loan. A lower interest rate thus results in a higher market value.

(+) Lower interest rates = (+) higher market value

Cost

In current times, the costs of reused materials are unfortunately often higher. This is due to high labor costs and there is no mass production advantage for circular products yet.

(-)Higher investment costs = (-) potential lower market value

This could change gradually when the raw material prices keep rising as they have over the past years. It could be possible that in the upcoming years the costs of reused materials are lower than raw material prices.

(+) Lower investment costs = (+) potential higher market value

https://www.dutcharchitects.org/projects/sports-facility-wageningen

10

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Circular Checklist

TU Delft

1. Onset of new client, to conduct valuation of a commercial, office property in the Netherlands.

2. If the property claims to have no sustainable elements, continue valuation as per already existing parameters. But if the building claims to incorporate sustainable principles, continue to step 3.

3. If the focus is on sustainable certificates (e.g., BREEM), continue valuation as per already existing parameters. But if the building has a hint of Circular Economy principles (as per description provided), continue to step 4.

4. If the building has any of the Circular Principles described, it will have the following impacts on some of the valuation parameters, as shown below.

Maximized potential for high quality reuse	Design for maximum functional lifetime	Maximize the amount of reused materials	Minimize the amount of new (virgin) materials
Vacancy Rate (lower)	Vacancy Rate (lower)	Interest Rate (lower)	Cost (lower)
Income (higher)	Cost (higher)	Cost (lower)	

Maximum bio-based materials	Design for optimum management and maintenance	Design for multiple lifecycles	Design with minimum amount of materials
Interest Rate (lower)	Vacancy Rate (lower)	Vacancy Rate (lower)	Cost (lower)
Cost (higher)	Cost (higher)	Cost (higher)	
Income (higher)	Income (higher)	Income (higher)	
		Time Frame (longer)	

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