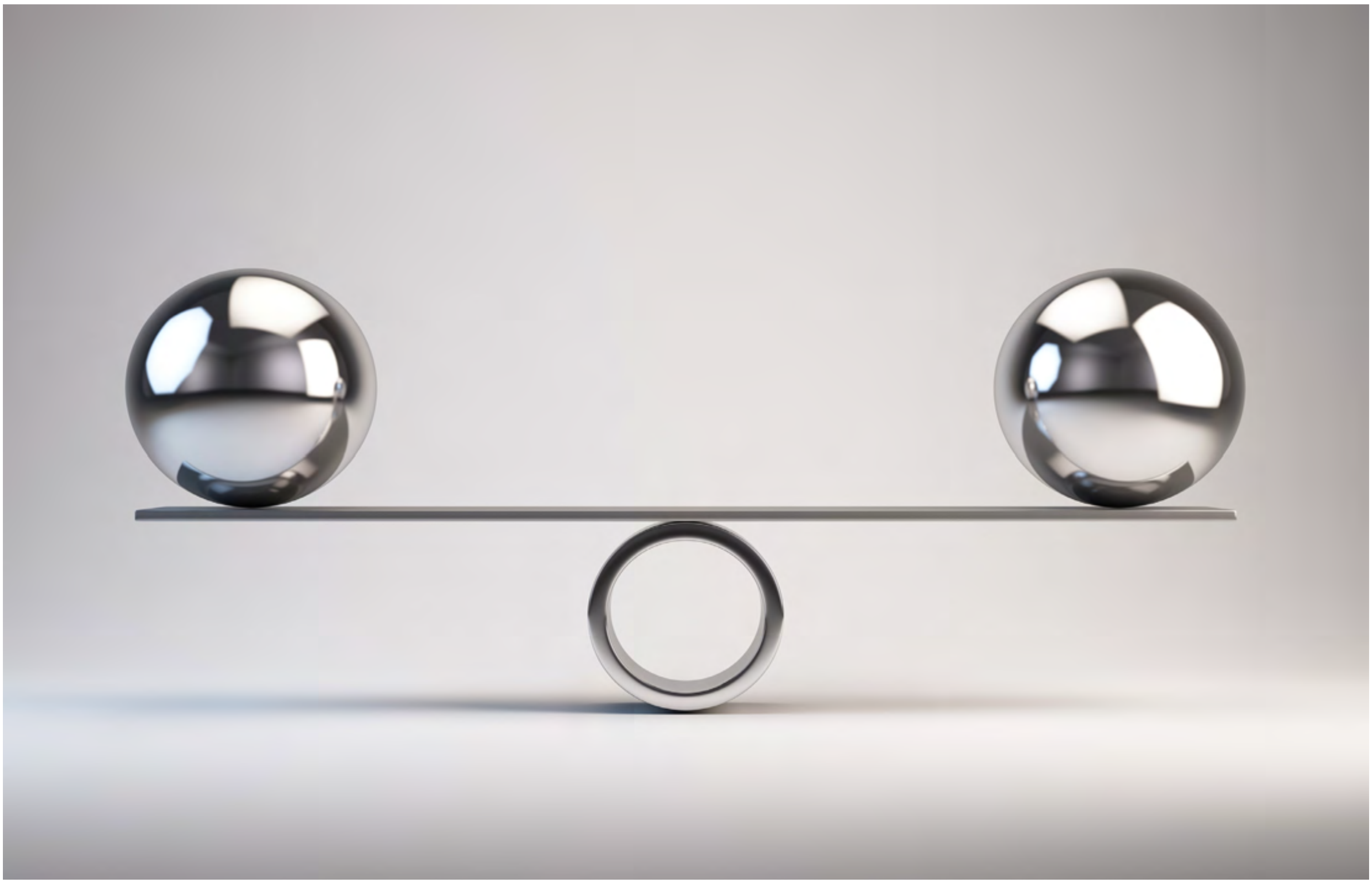
Sustainable Building Alliance

# SB Alliance research project

## Sustainability thresholds generating Value



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# WHO WE ARE

Founded in 2009, SBA is the world's premier organisation for the sustainable building certification industry.

We bring together operators of rating and certification tools for sustainable buildings, standard setting organizations, national building research centres as well as key property industry stakeholders and manufacturers of construction products.

Our purpose is to advance quality certification and promote its role for the development of sustainable buildings. To achieve this, we:

Provide guidelines for transparency and quality assurance for certification systems

Offer market feedback to the European Commission when new regulations are being developed

Advise the European Commission and national governments on the role certification can play to advance sustainability in construction and the built environment

Facilitate industry-wide collaboration towards a common understanding of how regulations, information and the certification process may be harmonized

Lead partnerships for research on innovations in tools supporting the construction market for sustainable buildings

# FOREWORD

*Collecting and having access to good data is unquestionably an essential part of ensuring we understand effective quality and performance of real estate. The deployment of rating tools has created quality tags that could drive contemporary best practice outcomes. In addition, the market penetration of Building Information Modeling (BIM) could help organized the huge amount of data available for Life Cycle Assessment and performance evaluation. There is thus a new opportunity to look beyond and leverage rich data sets 'au naturel', organized around common baselines. The question is now how we incorporate the information collected into our investment decisions to pave the way for a more responsible real estate sector.*

*The translation into the valuation process and the assessment of the sensitivity to future changes is the bridge we should built to achieve this necessary transformation. It will empower new models of investment, best practice definitions and aggregated accountability that will unlock capital flows toward safe, comfortable and low carbon property. The translation into value will help foster the necessary trust and alignment of interests between stakeholders required to create a virtuous mechanism of joint value creation. The transparency on uncertainty (spread between theoretical data and reality) will also definitively be needed in order to aggregate (without huge mistakes) the projects into a portfolio. This is the demand from financial institutions in order to initiate the massification of energy efficiency retrofit for example.*

*This report investigating how sustainability-related information translates into value and how it could be better incorporated in investment decisions represent a solid step in this direction.*

Frank Hovorka
Chairman of the SB Alliance
Coordinator of the report

# CONTENT

# SUMMARY

## PRESENTATION OF THE RESEARCH PROJECT

*This report synthesises the results from a research project investigating the impact of the sustainability performance of buildings on their economic value. The aim of the research project was to understand how the sustainability features of buildings can "translate" into economic value and to make suggestions to improve the integration of sustainability-related characteristics into investment decision-making process and asset valuations.*

*The stance adopted is consistent with the diagnosis established in the UNEP FI Metrics report (2014). It has now become widely acknowledged that the sustainability performance of buildings impacts real estate investment worth and market value. Although investors and valuers are under professional obligation to collect more and more sustainability-related data, the information is still under-used in valuation exercises and investment decision-making process. Integration into value assessments would contribute to firmly embedding sustainability criteria into investment contexts.*

*The research proceeded in two stages. The first stage laid the foundations by questioning the sustainability performance of buildings and the value associated with this performance. In particular, various studies on the impact of sustainability features of buildings on asset value were identified and listed. The second stage focused on the integration of sustainability criteria into financial calculations. It resulted in the development of a generic framework using a Discounted Cash Flows methodology that was discussed during a workshop with experts.*

*Recommendations were thus drawn for both the certification bodies on the one hand, and the investment advisors / analysts and valuers on the other hand.*

## MAIN DISCUSSIONS

### • INVESTIGATING THE VALUE OF SUSTAINABILITY FEATURES IN REAL ESTATE

*There is an expanding literature on the value of sustainability features in buildings (European Commission, 2013; World GBC, 2013; World GBC, 2014). While several publications focus on the price differentiation between buildings with sustainability credentials and buildings with no sustainability credentials (Eichholtz et al., 2010; etc.), others examine the specific costs and benefits associated with the different sustainability features referring to both monetary and intangible values (Heerwagen, 2000).*

*These various studies usually refer to different concepts of value and encompass benefits that may not always directly profit the investors themselves. The value of sustainability-related features can thus be interpreted differently according to the stakeholders and scope considered. On the one hand, market value refers to the price at which the good would be traded in a perfect open market. On the other hand, a concept of total value could be defined to encompass the various benefits associated with sustainability features for the different stakeholders (investors as well as users, local authorities, citizens, etc.). This notion would include a wider range of benefits not always priced by the market. However, examining the mechanisms through which benefits for the different stakeholders could impact investors helps better understand the financial gains investors can expect from sustainability.*

## • DISTINGUISHING VALUE CREATION ASSESSMENTS FROM MARKET VALUE AND INVESTMENT WORTH APPRAISALS

*Two types of value assessment should be distinguished.*

*First, analysing the various benefits of sustainable real estate can enable investors to identify value creation drivers for their different stakeholders. In this context, sustainability-related features have a value which is not limited to the financial benefits priced by the market. This value can be economic (for example reduced life cycle costs), social and cultural (cultural heritage, urban revival, improved comfort, etc.), intangible and resulting from a better brand image or environmental (protection of environmental resources, climate change mitigation, etc.).*

*Second, assessing the impacts of sustainability performance on market value drivers (rents, rental growth, operation and capital expenses, letting durations, yields and risk premium) can enable valuers and investors to better integrate sustainability-related information into the calculation of market value and investment worth. Value corresponds here to a financial concept, which calculation is framed by professional valuation bodies and reflects anticipation on the cash flows.*

*Identifying the various benefits of sustainability-related features for the various stakeholders may help inform financial appraisals. However, at a given date for a given type of market, all the benefits identified may not be reflected in the financial value. In a shifting context, understanding the mechanisms at stake is paramount to determine how sustainability-related features can create value and take informed decisions. On the whole, there is no straightforward formula to translate sustainability performance into financial value. The exercise varies according to the building, the market context, the type of stakeholders, etc.*

## • DRAWING ON A HOLISTIC DESCRIPTION OF THE BUILDING PERFORMANCE

*As a starting point, sustainability-related features should be processed as constituents of an "extended" approach for describing building quality. A separate examination of building quality and sustainability-related features does no longer make sense.*

*Data collection should be integrated into design and building management processes. The cost of systematic data collection and storage would probably be lower than the costs of one-off due diligences. Data should directly be collected from the people who have access to the information, namely designers and contractors for new buildings, and facility managers for existing buildings. The verification of this information by third parties would increase the value of the data.*

## • INTEGRATING SUSTAINABILITY-RELATED INFORMATION INTO MARKET VALUE AND INVESTMENT WORTH

*Current valuation and investment decision practices partially incorporate sustainability-related features, but each to differing degrees. The presence of a sustainability certification (BREEAM, LEED, HQE, BNB/DGNB or equivalent) sometimes appears "translated" into an additional rental value in markets where certification schemes have not yet widely spread. Conversely, its absence increasingly leads to a discount in markets where certification credentials have become standard. Sustainability retrofits costs are usually included in capital expenses assessments, in particular when investors seek sustainability credentials. Adjustments are also sometimes made to operation expenses, letting periods and yields. However, the type and scale of the adjustments performed are still heterogeneous.*

*Improvements should be made to better account for technical data and individual features and develop a more standardised incorporation of sustainability topics in financial appraisals-. The Discounted Cash Flows (DCF) approach appears particularly appropriate to do so. The DCF input parameters (rents, rental growth, operation and capital expenses, durations to let, yields and risk premium) can be properly adjusted in a transparent manner. The adjustments completed should be documented. In particular, the DCF input parameters should be presented in a standardised format allowing for transparency on how sustainability-related features are integrated into the valuation. A generic format for this transparent and comprehensible integration is suggested in this report.*

*In addition, uncertainty associated with the reliability of the information used to assess sustainability performance and its potential impacts on market value drivers should be accounted for. Accounting for uncertainty in the input variables is paramount in order to avoid the impression of unrealistic levels of precision. Monte-Carlo simulation is a method of choice to account for the impact of uncertainties on the valuation output and present a sensitivity analysis.*

## ACCOUNTING FOR FLEXIBILITY AND ADAPTABILITY IN INVESTMENT WORTH APPRAISALS

*Integrating flexibility into investment worth appraisals and investment decision-making is important since flexibility can have a considerable impact on building occupancy rates, retrofit costs and environmental performance through lower consumption of building materials. Two key types flexibility should be distinguished: service flexibility and adaptability (Kendall et al., 2013). Currently there is no common explicit technical requirements, metrics or benchmarks to investigate these two types of flexibility. In addition, although building owners, valuers and analysts increasingly acknowledge the impact of service flexibility and adaptability on market value, there is no standardised framework to integrate flexibility-related information into investment decisions and valuation exercises.*

*Valuing flexibility in buildings is not straightforward due to the uncertainty on the potential future cash flows. Pricing flexibility is difficult because its value depends particularly on the uncertainty of the future organisational activities, i.e. whether the flexibility will be actually put into use (e.g., Vimpari et al., 2014). Since the value of flexibility is a contingent claim into the future, real option analysis (ROA) could be used to account for service flexibility and adaptability. Based on expert interviews and a review of state-of-the arts projects and studies, this report suggests valuers and analysts to apply ROA as a supplement to the DCF valuation. A simple calculation using payoff methods is presented. This method is practical and straightforward, as only three payoff scenarios are needed for the appraisal.*

## ACCOUNTING FOR RISKS AND RESILIENCE AGAINST FUTURE CHANGES

*Current valuation methods do not account very well for risks associated to market context shifts. However, future changes in the users' expectations or in the regulatory framework do impact property value since for example retrofit works would be required to maintain the building attractiveness. A flexible design enabling the owner to adapt his building to the evolutions of the context would offer a protection against these risks and would thus improve the value of the building. For example, better fits between users' needs and buildings space can improve occupancy rates and reduce capital costs required to update the building. In special cases –in particular for owner occupant willing to decide between different retrofit solutions- a simplified real options method may be used to calculate an option value or a sustainable flexible design. The output may be added to the DCF results, in particular for office buildings.*

## LISTS OF RECOMMENDATIONS

| Recommendations to valuers and investment advisors/analysts |
|---|
| **1. Application of an holistic approach of building performance**<br>The analysis of the sustainability performance of building should be part of a holistic assessment where sustainability features are part of the building description. The appraisal should not neglect building life cycle, building integration in the neighbourhood and the broader scope of impacts for all stakeholders. |
| **2. Distinguishing between brand value of labels and the value of sustainability features**<br>The investigation of the value should distinguish between the brand value of the presence of a certification schemes and the value of sustainability features themselves. In the first case, the value associated with the sustainability features comes from the "sustainable" image conveyed by the label and the trust associated with its reliability. |
| **3. Broadening the understanding of value**<br>The investment decision making-process should not overlook the benefits of sustainable features which may not be directly reflected in the market. In particular, investigating the various benefits for the different stakeholders and the non-financial value (social value, environmental value, cultural value, immaterial value…) of sustainable real estate may help investors identify wealth creation drivers which may improve the acceptability, attractiveness and positive spinoffs of buildings and ultimately benefit the investors themselves. |
| **4. Accounting for sustainability-related information more transparently within valuations through Discounted Cash Flow (DCF) methodology**<br>The integration of the impact of sustainability-related features into valuation should take place as transparent as possible in a DCF framework. This report proposes a generic format for this integration with recommendations on how each sustainability feature should be accounted for. This generic format should be adapted to the different applications of DCF methodologies across countries and market segments. |
| **5. Accounting for uncertainty through Monte Carlo simulations**<br>The uncertainty associated with the appraisal exercise should be documented; ideally through the application of Monte-Carlo simulations, a probabilistic technique broadly used in financial risks calculations, with the calculation of best case, worst case and best guess scenarios. |
| **6. Accounting for adaptability and flexibility**<br>The building appraisal should also account for the adaptability and flexibility of the building design. This investigation can help better understand and assess building resilience against evolutions in the future context or in the future expectations of users. This report suggests using real options analysis (ROA) as a mean to calculate the value associated with a flexible design in financial appraisal of buildings. |

| Recommendations to certification bodies |
| --- |
| **1. Providing more information on the sustainability performance in use**<br><br>The certification bodies should improve its assessment of the sustainability performance of buildings in use. Performance in use is paramount to ensure a long term trust in the label and to appraise to benefits which may ultimately “translate” into value. Therefore, assessments during the design stage should always be complemented, at appropriate intervals, through in-use assessment results. |
| **2. Better highlighting sustainability features which have the stronger impact on value**<br><br>Sustainability features such as internal comfort/user satisfaction, health-friendliness of construction materials, flexibility and adaptability, the integration into the neighbourhood, and operating costs should be better accounted in the certification schemes. |
| **3. Provide sustainability-related information in a format more easily usable by investors, valuers and analysts**<br><br>Certification schemes should provide raw information on the building which investors, valuers and analysts could directly use in their data collection and assessment processes. This means that there is a high-demand for disaggregated assessment results and for comprehensive documentations of main building characteristics and attributes. |

# INTRODUCTION

## Background

Sustainability agenda in real estate has been rapidly moving forward over the last past years. Due in particular to regulatory pressure and market shifts in the users and investors‘ expectations, several topics have even become market standards and are no longer a niche issue. To meet these trends, the collection of sustainability-related information on buildings is gradually taking momentum. UNEP FI's Sustainability Metrics Report (2014) highlights that a growing portion of organizations are now struggling to build a corporate real estate sustainability management system to collect data on the sustainability performance of buildings and integrate it in their decision making process. However, most players are still at an early stage and question remains as regards how to use the information and data collected into investment decision process and value calculations. In particular, the report states: "*Although concern exists about the growing demands for ever increasing data, investors are asking what relevance all these data have for their investment and asset management decisions*." (UNEP FI, 2014, p.10)

Numerous publications and academic studies have documented the positive benefits of sustainability features in buildings. The benefits highlighted include monetary gains through expenses savings, improved risk management, reputation gains for both investors and users, economic spinoffs resulting from urban revival at a neighbourhood scale, etc.(World GBC, 2013; World GBC, 2014) There is now a growing appreciation that these benefits will translate into added financial value for investors themselves. This awareness is supported by past studies highlighting a market value gap between certified buildings and non-certified buildings. However, further research is still required to understand the underlying mechanisms at stake and to develop a standardized methodology to account for these benefits in a transparent manner.

The professional body RICS advises valuers to collect sustainability data and assess their potential impacts on value. In the revised edition of the guidance note *Sustainability and commercial Property Valuation* published in October 2013, valuers are advised to "*collect appropriate and sufficient sustainability data as and when it becomes available for future comparability even if it does not currently impact on value.*" The 2014 RICS Red Book goes a step further by recommending valuers to "*assess the extent to which the subject property currently meets sustainability criteria and arrive at an informed view on the likelihood of these impacting on value."*

Although sustainability data is increasingly collected, the information is still largely under-employed. Translation into economic and financial ratios would ensure a better integration of sustainability information into investment decision process. It is no longer a question about "if" sustainability criteria need to be integrated but a question about "how" to do it.

## Aim of the research project

The aim of this research project is to understand how sustainability attributes of building can be "translated" into performance and ultimately into value. More precisely, the research project :

- Investigates the concept of value associated with sustainability performance in buildings. Different types of value are distinguished according to the monetary nature of the benefits and the stakeholders considered which may or may not impact the financial/market value for investors and the building worth for users.
- Examines the integration of sustainability-related data in current investment decision contexts, in particular the strengths and weaknesses of current practices and the needs for information.
- Proposes more standardised guidelines to better integrate sustainability information into investment decision process and in particular into financial value calculation.
- Discusses pathways to account more transparently for uncertainty and risk management associated with sustainability features and reliability of information.

The objective is to:

- **Help investors** to better use sustainability information collected by real estate management systems and embodied in certification schemes in investment decision-making process.
- **Help valuers** to integrate sustainability-related features more transparently and uniformly.
- **Help certification bodies** to better understand investors' and valuers needs with regard to sustainability metrics and assessments.

## Methodology

The project was divided into two parts spread from spring 2012 to autumn 2014.

The first step of the project gathered various stakeholders (construction industries, certification bodies, investors, users, academic researchers) to develop a common understanding of key notions relative to sustainability performance in buildings and their impacts on the different types of value.

The second step of the project gathered a smaller team of academic researchers to investigate more precisely the investment context and propose more concrete recommendations for investors, valuers and certifications bodies. The methodological approach involved :

- Review of existing literature and initiatives,
- Interviews with expert from different target groups,
- Analysis of case studies.

A workshop gathering a dozen of specialists from different target groups (valuers, in house analysts, industries, sustainability service providers and policy makers) was organized in October 2014 to discuss the results and examine recommendations.

## Structure of the report

This report comprises four sections**. First section** presents the results from the first step of the project. It discusses the concept of value and highlights the relations between the benefits associated with sustainability features, the measurement of sustainability performance and the different types of value (financial, economic, immaterial, social and environmental). **Second section** investigates the current practices as regards the integration of sustainability-related data into investment decision process and valuation exercises. Both a review of literature and interviews with different market players are used. **Third section** suggests different recommendations for valuers and investors whereas **fourth section** is dedicated to recommendations to certification bodies.

# SECTION 1: CLARIFYING THE VALUE OF SUSTAINABLE REAL ESTATE

In order to discuss the integration of sustainability-related information in the investment decision-making process, it is first necessary to clarify which value is concerned and how it relates with the **sustainability performance** and its associated benefits for the different stakeholders.

This section presents the results of the first stage of the project and discusses the concept of value for sustainability in real estate. The main objectives were to:

- Set common definitions on the concept of performance and value,
- Describe the conceptual framework through which building characteristics can be translated into benefits for the different stakeholders,
- Discuss practical implications to translate indicators into value for the different stakeholders.

This clarification of the concept of value appeared as a useful starting point to lay the foundations for a dialogue with the various stakeholders and a standardization of the topic at hand.

## 1.1 From property characteristics to sustainability performance

There are various definitions of sustainable real estate. This report rests on a global definition which does not stop at environmental considerations.

### ▪ Defining sustainability in the building sector

The application of the concept of sustainable development to the construction and real estate sector has been subject to standardisation in the **ISO 15392:2008**. This international standard proposes general principles for the analysis of sustainability along the whole life cycle of buildings. Sustainability is presented as the minimisation of adverse impacts and the encouragement of positive spinoffs at both a local and global scale discussing economic, social and environmental aspects. Environmental aspects include the use of resources and impacts on the environment such as energy, water, waste, greenhouse gas emissions and more globally resources depletion, etc. Social aspects encompass impacts on life quality such as health and comfort and interactions with society such as social equity, cultural heritage, etc. Economic aspects include in particular life cycle costs and value stability.

The ISO 15392 standard does not provide references to determine the level of sustainability of a given building. This question has been investigated further in the ISO 21929-1:2011 which provides a framework for the development and utilisation of a system of sustainability indicators for buildings.

The existing certification schemes (HQE, LEED, BREEAM, CASBEE, BNB/DGNB, etc.) for buildings and real estate usually rests on these standards although they usually encompass a smaller scope of considerations focused on environmental topics. They include an assessment of buildings sustainability features and propose weightings and scoring systems to benchmark buildings at an aggregated level.

### ▪ Assessing sustainability performance

Sustainability features complement the traditional list of information already collected to describe the building and appraise its performance in a more holistic manner (Lorenz and Lützkendorf, 2011).

As presented in the UNEP FI's Sustainability Metrics Report (2014), the characterization of buildings according to the various sustainability topics can be completed at different levels as presented in **Figure 1:**

- **Physical property characteristics** of the building such as the type of building envelope, the type of heating system, the lettable area and associated volume… They include building description, components as well as technical equipment characteristics and energy and water sources, etc.

- **Sustainability quality** which puts into perspective the physical property characteristics with the use of the building, the quality of its operation and the location characteristics, in particular the local climate.

- **Sustainability metrics** such as energy consumption, water consumption, distance to public transport etc. which correspond to partial measurements of the sustainability quality.

- **Sustainability performance** which results from an assessment of the quality achieved by a given building at a given location and its comparison with the quality achieved by other similar buildings in similar locations and with regulatory standards. The sustainability performance conveys the ability of buildings to meet current and future requirements and rests on the definition of benchmarks.

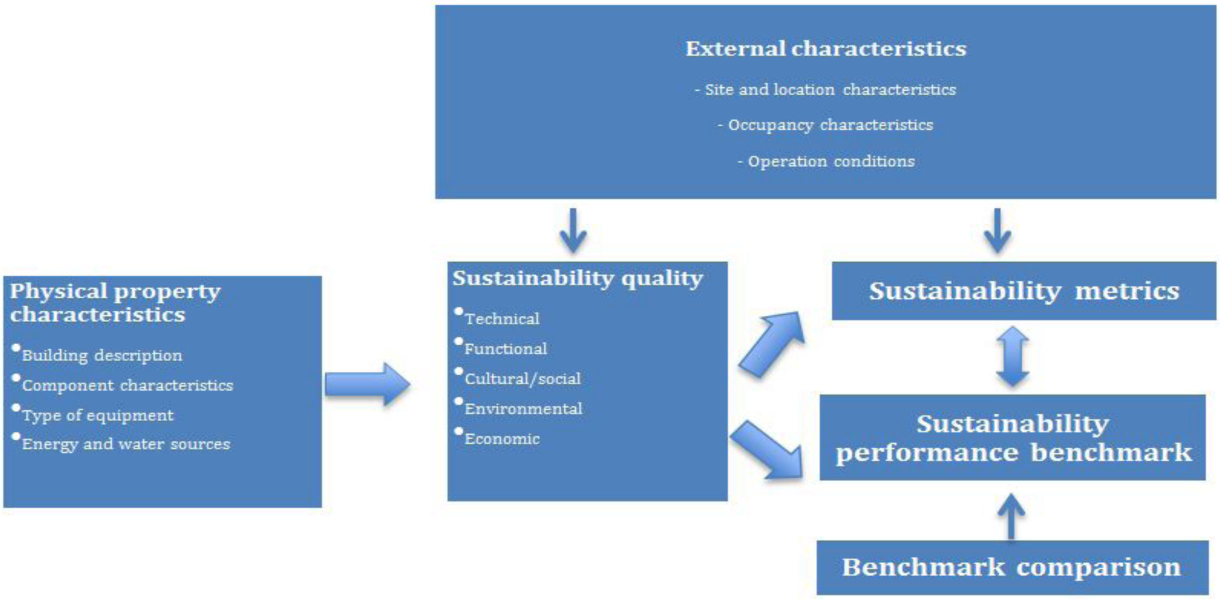



**Figure 1: From property characteristics to sustainability performance**

Sustainability performance does not come down to the mere intrinsic quality of buildings. It depends not only on the **quality of the technical installations** (the responsibility of which lies with the owner, investor or developer) but also on the **quality of the operation** (which largely depends on the property and facility managers) and on the **conditions of use** (users' behaviours) for a **given level of functionality and comfort** (suitability to users' needs and processes). In this sense, **it becomes necessary not only to assess the sustainability of a building during the design phase and at the time of completion, but also to assess the building during the use phase ("in-use" performance).**

In addition, three dimensions need to be systematically analysed to cover as entirely as possible sustainability-related issues:

- **Time**: Sustainability issues occur along the whole building life cycle, and impacts need to be assessed and compared along this same timeframe. The impacts of real estate need to be analysed from the conception of the building to its life in use and eventually to its demolition and recycling. The expected lifetime of the building strongly impacts the final result of the environmental appraisal. For example, a life cycle assessment may help compare between a building designed for 20 years with a reusable frame and a building designed for 50 to 100 years with bulk materials. Time dimension is in particular crucial to appraise building resilience and adaptability.

- **Local context**: Sustainability in buildings also encompasses topics related to neighbourhood, urban regeneration and economic and social spinoffs in the local area. An analysis of sustainability performance solely focused on the building would be insufficient to account for these interactions and would fail to identify the potentials associated with the mutualisation of flows at a local scale (such as development of smart grids and heat recuperation system, etc.).

- **Stakeholders**: Although real estate decisions ultimately depend on investors, other actors are affected by sustainability issues such as the tenants (institutions signing the lease), the actual users (employees in office premises, family occupying the apartments, etc.) the local authorities, the neighbourhood or even the society at large, etc.

## 1.2 Sustainability performance and benefits

**Different studies have highlighted the costs and benefits of sustainable buildings** compared to conventional properties. They have been synthesised in various publications including World GBC (2013, 2014), European Commission (2013). These studies have focused on sustainability credential as a whole or on each sustainability feature specifically (green rooftop, natural ventilation systems, etc.). These works still remain mostly either theoretical or case study-based. They suggest that many of the benefits are enjoyed by a wide group of stakeholders including :

- **The owner (landlord)**: At a building level, the financial benefits may include reduced operation expenses (e.g. for refurbishment), higher rents, higher sale prices, shorter letting periods, reduced regulatory risks resulting in lower risk premiums, etc. At a portfolio level, the benefits encompass the optimisation of the portfolio with a management more attuned to the life cycle of the building components and more resilient to shifts in the context. Last but not least, sustainable real estate can be integrated in a responsible investment strategy resulting in a better brand value image for the firm or a better "licence to operate" for governance issues in particular. It may be a factor of "corporate success".

- **The occupiers and users**: Benefits range from costs savings (energy, water, waste, etc.) and improved comfort and health to better adaptability of the premises resulting in lower churn costs. For office buildings, the studies suggest that the improved indoor conditions and accessibility at the level of individual users (employees) can translate into productivity gains at the level of the institutional occupiers (companies). These gains can be much larger than the mere savings associated with the operation expenses (energy, waste and water bills). In addition, occupying buildings with a sustainable brand can help companies develop a "green" corporate image and reputation.

- **The local authorities**: Well-designed management of natural resources at a building scale may entail costs savings for the public facilities. The settlement of a sustainable building in an area may also result into positive economic spinoffs at the neighbourhood level fostering urban revival. More broadly, it may improve the "community life" resulting in social and cultural benefits.

- **Society at large**: Sustainable real estate is of course associated with the contribution to the mitigation of climate change, the mitigation of resources depletion, etc.

Owners will directly benefit from a portion of the benefits resulting from the sustainability-related features, in particular unrecoverable operation expenses which cannot be charged to tenants. Other portion of their benefits (higher sale price, higher market price, etc.) will indirectly come from stakeholders positively affected by their decisions as illustrated in **Figure 2**.

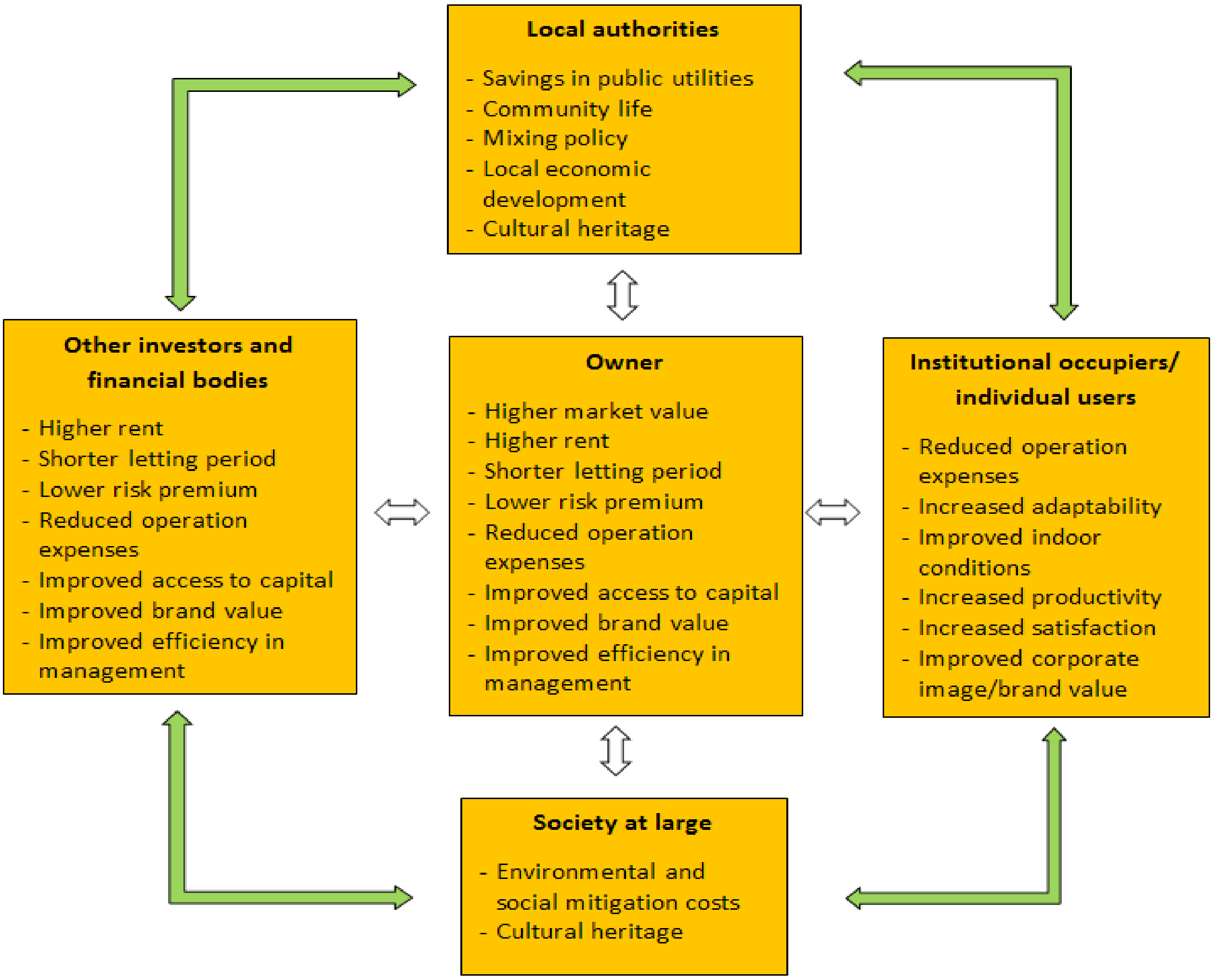



Figure 2: Example of benefits resulting from sustainability features for owners and some of their stakeholders

## 1.3 Different concepts of value

Before investigating further, it appears crucial to clarify the meaning of value used in the different studies. All these approaches rely on different understanding of the concept of value. They do not seek to quantify the same things. In order to "translate" these different benefits into value, the first question is to come on an agreement as regards the concept of value referred to. The notion of value can be interpreted differently according to the stakeholders and scope considered. Specifying the context is paramount to undertake a valuation exercise as it will determine "whose interests" are to be counted in the process.

- **Different types of "value"**

Interviews with the different professionals of the real estate and construction industry during the first stage of this research project have highlighted diversity in the interpretations of the concept of value. An engineer from the construction industry was interested to convey the improved performance of its company' s products to investors. For him, valuing sustainability meant assessing the sustainability performance of buildings and translating those performance in indicators adapted to investors. He focused on the economic value resulting from the comparison of the life cycle costs of the building components. Conversely, different valuers hired by owners to review their property value (for sale purpose or as a regulatory requirement for balance sheet) failed to see sustainability performance and appraisal as an issue. For them, valuing sustainability meant assessing whether there was evidence that environmental certification schemes affected the market transactions.  Several investors wishing to reinforce their responsible policy in property investment wondered at how to value sustainability in investment decision process. For them, valuing sustainability offered an opportunity to anticipate the market and contribute to the sustainability agenda. Last, a public investor wanted to examine the positive spinoffs associated with sustainable real estate. The value considered was not restricted to monetized benefits.

The first question to attempt to value sustainability in real estate is thus to determine which definition of value is considered and what purpose should serve the appraisal exercise. If value is perceived as the best use value (in terms of best functional option for engineers), sustainable performance corresponds to improved quality and efficiency in the use of resources, and is intrinsically "worth" more. However, if value is understood as price or market value, sustainability performance depends on the willingness-to-pay of tenants and other investors and will thus vary over time and space according to the market context. In addition, some benefits may not all be directly monetized.

- **Propositions of categorisation for the value of sustainability in real estate**

There are various definitions and types of value. In this project, we suggest using the following terms to distinguish between the various types of value. It should be noted that these definitions do not stem from the same conceptual background and may be overlapping.

**Market value**

Market value refers to the price at which goods would be traded in a perfect open market. If price is defined as the actual observable exchange price in an open market, market value is the estimation of the exchange price in a market place with all agents being informed (French, 1997). More precisely, the International Valuation Standards (IVS) Council defines the market value as:

"The estimated amount for which an asset or liability should exchange on the valuation date between a willing buyer and a willing seller in an arm's-length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion." (IVSC, 2013, p. 5)

Worth (or investment value)

Market value of real estate assets should be distinguished from the buildings worth (or investment value) which corresponds to a specific investor's assessment of the monetary benefits associated to the ownership of the asset (French, 1997). Whereas market value refers to the value in a transaction, worth reflects the particular context and objective of a given investor. More specifically, investment value is defined by the International Valuation Standards (IVS) Council as : "The value of an asset to the owner or a prospective owner for individual investment or operational objectives."(IVSC, 2013, p. 5)

**Use Value**

The financial notions previously discussed are focused on the investors and do no not necessarily account for the benefits perceived by the occupiers themselves. Use value could thus be coined to refer to the benefits expected from the utilisation of a good or service. The benefits may not always be monetary gains and use value may also encompass intangible benefits. For sustainable buildings, use value may thus account for the benefits in terms of operation savings but also functionality, organisational efficiency and productivity in commercial buildings. This is the working angle developed by Berardi and Eymeri (2013) to investigate the contribution of office premises to the performance of businesses.

**Intangible value**

Intangible value refers to the value of the intangible assets of a company (also called intellectual capital) such as its brands, patents and processes (internal structure capital), its employees' skills and knowledge (human capital) and its networks of clients and contractors (external structure capital) (Hussi, 2004). In sustainable real estate, intangible value could thus be understood as the value associated with the intangible benefits of the occupation or the holding of a sustainable building. This value also includes benefits associated with brand, image and reputation that are not directly linked to the tangible benefits of sustainability performance. If the brand performance may have financial costs and benefits, intangible value also takes account of the intangible benefits associated with the brand. Based on this concept, Fustec et al. (2013) have suggested identifying and listing all the benefits an organisation could expect from the occupation of a sustainable real estate.

**Total value**

The total value of sustainability features could be understood as a notion encompassing all the benefits of sustainability features, whether they correspond to monetised gains priced by the market or not. This concept is adapted from the "Total economic value" coined in Environmental Economics (Turner et al., 2003) to assess human preferences for ecological ecosystems investigating both the value stemming from effective or potential benefits and the value associated with the mere existence of the sustainability features. It is also closely linked to the concept of public value which describes collective interest as opposed to the pursuit of individual preferences (Bradwell et al., 2007). Sustainability features may indeed entail intangible and social benefits which may not always be reflected in market prices, such as the protection of the biodiversity, social inclusion, urban regeneration, cultural heritage, fight against climate change, etc. The total value could thus refer to the sum of all these benefits at the individual and collective level which may not all be priced in terms of monetary figures. It includes:

- **Social value** associated with the integration into community life, health, safety, prosperity creation for the neighbourhood, etc.
- **Environmental value** associated to the protection of the biodiversity, the ecosystems and the mitigation of resources depletion.
- **Cultural value** resulting from the aesthetics and cultural heritage associated with a building.
- **Economic value** associated with the life cycle costs of a building and its components and the long term economic development spinoffs for the neighbourhood (employment, local development, etc.).

- **Types of value favoured by the different stakeholders**

Depending on their position and their individual and institutional motives and goals, owners and their various stakeholders develop different value systems and focus on different value drivers. Figure 3 provides a brief overview of the different types of value categories and their assumed degrees of relative importance for the various groups of actors within the property and construction markets. If financial players are mainly concerned by financial value (market value or worth), owners are also concerned by image, social and use value. Government and local authorities are more heavily focused on the social and public value as well as the environmental value.

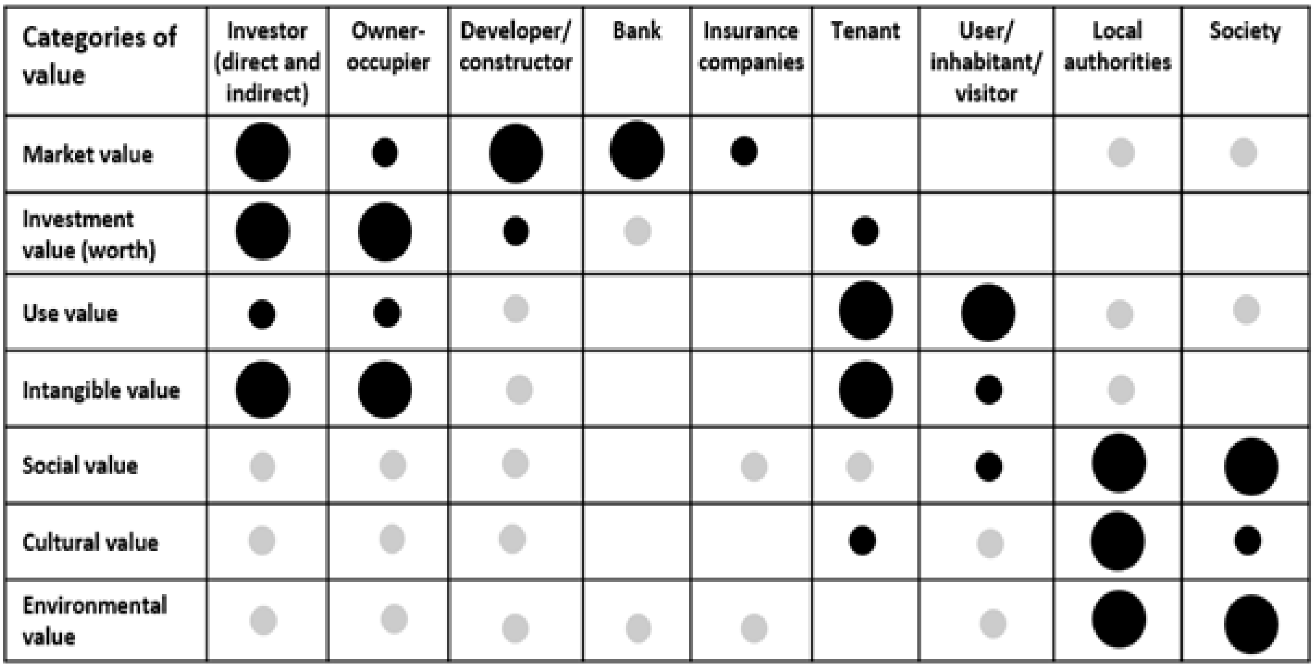



Figure 3: Categories of value favoured by the different market players
(adapted and modified from D. Lorenz / T. Lützkendorf)

- **Interactions between the different types of value**

**Worth and market value only account for a small portion of the total value of sustainability features perceived by the various stakeholders.** They only encompass financial gains and losses collected by investors in a given context. However, they are also impacted by the other types of values as suggested in **Figure 4.**

Understanding interactions between the different types of value is paramount to better understand how sustainability may impact worth and market value. It may enable investors and valuers to distinguish mechanisms not currently reflected in market prices but which raise financial risks in the longer run. Shifts in the demand and in the regulatory context could extend the scope of issued reflected in prices. A carbon tax for example would create a monetary value for the reduction of GHG emissions.

Analysing the full scope of sustainability benefits and their potential impacts on the different types of value is crucial to understand how value is created and may evolve over time according to shifts in the context. A widening of the scope of stakeholders considered and types of value considered can help draw a map of value creation chains and the different benefits that can ultimately be reflected in the market value. An illustration is proposed in **Figure 5.**

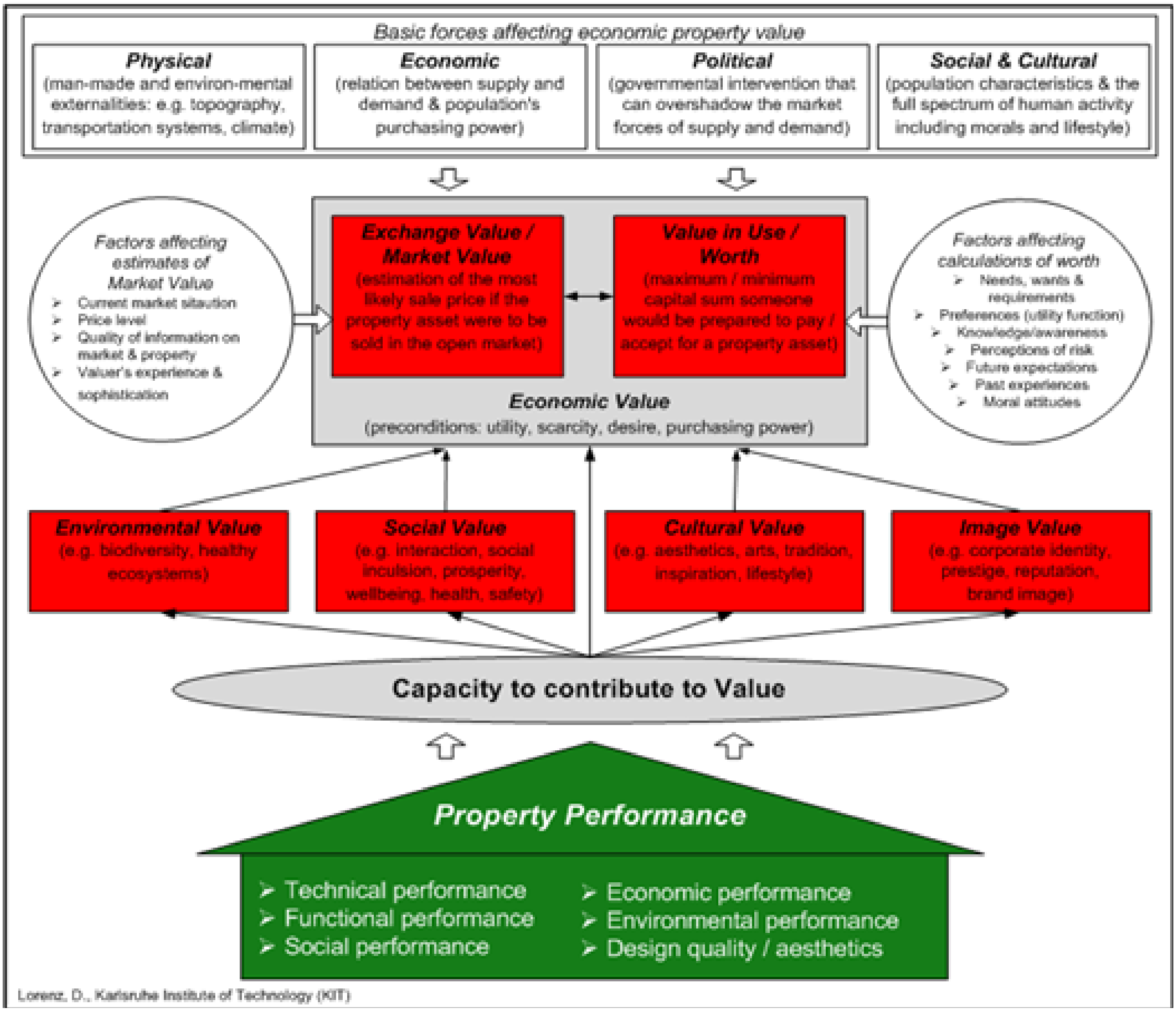
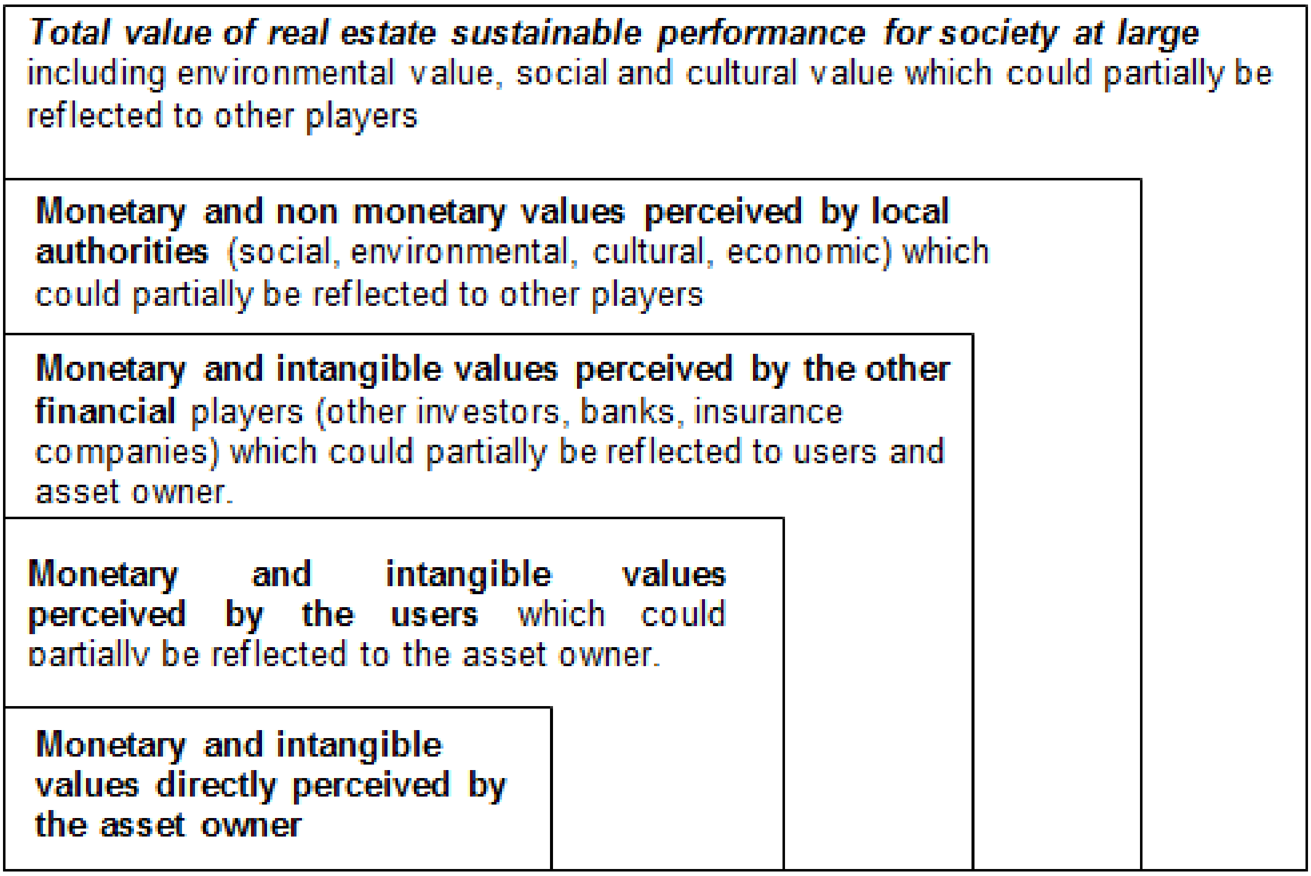



**Figure 4: Interactions between the different types of value** (source: D. Lorenz/ T. Lützkendorf)

(Figure created after: RICS, 1997; Pearce and Barbier, 2000; McParland et al., 2000; Appraisal Institute, 2001; Kohler and Lützkendorf, 2002; Gaddy and Hart, 2003; Morris Hargreaves McIntyre, 2006; CABE, 2006; Macmillan, 2006.)




## 1.4 Examining potential impacts on worth and market value

For each sustainability feature, different benefits and drawbacks can be identified along the building life cycle for the different stakeholders (investors, occupiers, local authorities, society at large). These benefits can be translated into worth and value through various mechanisms. Parts of these benefits are already being reflected in the market prices.

- Synthesis on empirical results on market prices

**An expanding academic research area specifically investigates the premium reflected in the market prices and rents of certified buildings.** The authors mostly use hedonic regressions on prices (sale prices or rents) to appraise the implicit value of each characteristics of a building (location, size, condition of the property, overall quality, presence of a certification, etc.). The value obtained for the presence of a sustainability certification scheme corresponds to the added value also called “green value” due to sustainability features all other things being equal. Although specific results between the studies differ, there is now important supporting evidence on the existence of rents and prices premiums through historical transactions data. Key results for office buildings and residential buildings are synthesized respectively in **Table 1** and **Table 2.**

As a first step, the disaggregated results from hedonic regressions could help built tables providing the spread of value related to sustainability performance for different typologies of buildings and different locations. Such benchmarking tables could thus be used by valuers and financial analysts as inputs for their market value calculations. However, these empirical results correspond to statistical figures and cannot be used directly for valuation exercises. The translation of benefits into financial value will differ from one premise to the next according to market and regulatory contexts.

Muldavin (2009) as well as Lützkendorf and Lorenz (2011) and Warren-Myers (2012) have criticized the use of hedonic studies on "green value" to value sustainability in buildings. First, they remark that data would need to be disaggregated at a sub-market level to be usable. Second, they pinpoint that using hedonic results would introduce a lag in the resulting valuations. Hedonic results are based on historical data. As sustainability is rapidly evolving, these data become rapidly obsolete and cannot be used accurately by valuers which require appraising the future building cash flow for the next ten years or so. Last but not least, they reckon that hedonic results may correspond to a brand value (the brand value of the certification) rather than the result of the sustainability performance itself. They advocate a specific accounting of the various sustainability features as part of the building performance overall assessment.

Further research is still necessary to identify which features do contribute to this added value. Investigations on the links between sustainability features and value would thus help investors to incorporate sustainability criteria in their investment decisions and certification bodies to adapt their labels so as to better meet investors' needs. On the whole, hedonic results may provide insights for valuers on how the market "perceives" sustainability but would not be appropriate in valuation calculations or to improve the investment decision-making process.

Table 1: Articles on the market premiums for commercial buildings

| Articles | Certification schemes, ratings | Country | Market price | Rental price | Occu-pation rate | Other comments |
|---|---|---|---|---|---|---|
| **Fuerst and McAllister (2008)** | LEED and Energy Star | USA | 31-35% | 6% | | |
| **Wiley *et al.* (2008)** | LEED<br>Energy Star | USA | 130$/square foot<br>30$/square foot | 15-17%<br>7% -9% | 16-18%<br>10%-11% | Class A buildings in 26 US office rental markets and 46 sales office market. |
| **Miller *et al.* (2008)** | LEED<br>Energy Star | USA | 10%<br>6% | | | |
| **Kok (2008)** | LEED and Energy Star | USA | 16% | 6% | | |
| **Pivo and Fisher (2009)** | Energy Star | USA | 6.7%-10,6% | 4.8%-5.2% | 0.2-1.3% | (regeneration zones) |
| **Eichholtz, Kok and Quigley (2009)** | LEED | USA | NS | | | |
| **Eichholtz, Kok and Quigley (2010)** | LEED and Energy Star | USA | 16% | 6% | | |
| **Fuerst and McAllister (2010)** | LEED<br>Energy Star | USA | | | 8%<br>3% | |
| **Eichholtz *et al.* (2010)** | LEED<br>Energy Star | USA | 11.1%<br>13% | 5.9%<br>6.6% | | |
| **Kok, Newell and MacFar-lane (2011)** | NABERS 5 stars<br>Green Star | Australia | 9%<br>12% | 3%<br>5% | | |
| **Fuerst and McAllister (2011)** | LEED<br>Energy Star | USA | 26%<br>25% | 5%<br>4% | | |
| **Kok and Jennen (2011)** | EPCs and accessi-bility | Nether-lands | | -6.5% for inefficient buildings | | |
| **Das *et al.* (2011)** | LEED | USA | | 2.4% in a down-mar-ket<br>0.1% in an up-market | | Green property rents may pro-vide a hedge in down markets |
| **Fuerst, Tommasso and McAllister (2012)** | LEED (2007 – 2012)<br>Energy Star (2007-2012) | USA | NS<br>4.5% | | | 11% for dual certified buildings (LEED + Energy Star) |
| **Kok, Miller and Morris (2012)** | LEED EBOM (2005 -2010) | USA | | 7% | | |
| **Reichardt *et al.* (2012)** | LEED (2000- 2010)<br>Energy Star (2000-2010) | USA | | 2.9%<br>2.5% with a peak in 2008 | NS<br>positive | |
| **Fuerst, van de Wetering and Wyatt (2013)** | EPCs | UK | | 11% (A-C rated) | | Lower service charges for rated A-C |
| **McGrath (2013)** | LEED and Energy Star | USA | | | | capitalization rates 0.364 lower than their non-certified coun-terparts |
| **Nappi-Choulet and Dé-camps (2013)** | French EPCs (DPE) | France | Positive for industrial | Positive premium for all types of building | | |
| **Bonde and Song (2013)** | EPCs | Sweden | NS | | | |
| **Chegut, Eihholtz and Kok (2014)** | BREEAM (London) | UK | 26% | 21% | | Premium decrease with the share of certified buildings in the neighborhood |
| **Gabe and Rehm (2014)** | NABERS | Australia | | No premiums | | |
| **Das and Wiley (2014)** | Energy Star<br>LEED | USA | 16.4 %<br>10.6% | | | LEED premia are increasing with market acceptance, rather than decreasing as the novelty effect expires |
| **Newell, MacFarlane and Walker (2014)** | NABERS | Australia | Positive | Positive | | |
| **Veld and Vlasveld (2014)** | Energy Star (Retail) | USA | NS | NS | | income return: 0.52% |

Table 2: Articles on the market premiums for residential buildings

| Articles | Ratings | Country | Market price | Rental price | Other comments |
|---|---|---|---|---|---|
| **Brounen and Kok (2009)** | EPCs (A, B or C) | Netherlands | 2.8% | | |
| **Griffin et *al.* (2009)** | Energy Star and LEED | USA | 3% -9.6% | | Sale duration: -18 days |
| **Salvi *et al.* (2010)** | Minergie | Switzerland | Individual houses : 7%<br>Collective dwellings: 3.5 % | collective : 6% | |
| **Brounen and Kok (2011)** | EPCs (A, B or C) | Netherlands | 3.7% | | |
| **Zheng *et al.* (2011)** | "greenness» measure | China | Positive at development<br>Negative at resale | | Authors' construct for "greenness" measure |
| **Yoshida and Suguira (2011)** | Tokyo Green Labeling System | Japan (Tokyo) | -5.5% for green buildings | | Condominiums |
| **Addae-Dapaah and Chieh (2011)** | Green Mark | Singapore | 11.69% | | No higher premi-ums for higher certi-fication level |
| **Deng and Quigley (2012)** | Green Mark | Singapore | 4% - 6% | | |
| **Aroul and Hansz (2012)** | Green transactions | USA (Texas) | 4.69% at program enactment<br>3.03% at program revision | | impact of mandato-ry green program |
| **Yoshida and Suguira (2013)** | Tokyo Green Labeling System | Japan (Tokyo) | Varies over time | | Initial green premi-um can be negative but becomes posi-tive as the building ages |
| **Fuerst *et al.* (2013)** | EPCs | UK | EPCs A and B sold for 14% more than EPC G | | Higher premium for terraced dwellings and flats compared to detached dwell-ings |
| **Walls, Palmer and Gerarden (2013)** | Energy Star and local green certifications | USA | Positive only for homes built between 1995 and 2006 | | (three metropolitan areas) |
| **Hyland, Lyons and Lyons (2013)** | Building Energy Ra-tings (BERs) | Ireland | 11% for A-rated buildings (1.3% increase per EPC rating) | 2% for A-rated buildings (0.5% increase per EPC rating) | |
| **Cajias and Piazolo (2013)** | EPCs | Germany | -0.45% for 1% energy consump-tion reduction | -0.08% for 1% energy consumption reduction | +3.15% for building return |
| **Högberg (2013)** | EPCs | Sweden | Positive | | |
| **Lyons (2013)** | CPEB ratings | Belgium | Positive | Positive | Price effect is sig-nificantly smaller at low CPEB scores – disappears at very low score |
| **Ademe (2013)** | EPCs (DPE) | France | individual houses : 15% for rat-ings A, B compared to D, -10% for ratings F and G | | |
| **Kahn and Kok (2014)** | EPA, LEED and GreenPoint | USA (Califor-nia) | 2-4 % | | single-family home |
| **Deng and Wu (2014)** | Green Mark | Singapore | 10% at resale stage<br>4% during the presale stage. | | |
| **Fuerst and Shimizu (2014)** | Tokyo Green Labeling System | Japan (Tokyo) | 5.9% asking price<br>1.8% transaction price | | increase in the first years, decline of the premium over the last two years |
| **Freybote, Sun and Yang (2015)** | LEED Neighborhood | USA (Portland) | Non significative | | spatio-temporal au-toregressive (STAR) model |

**Although hedonic studies provide good evidence, they cannot be used directly to value sustainability in decision-making process. The previous empirical results correspond to statistical estimations which cannot directly be applied in valuation exercises. The valuation of sustainability would entail adjusting the traditional valuation by an adjustment factor. However, for each building, this adjustment factor would vary according to the market type (location, supply and demand context, the type of tenants and investors, the market environmental standard, the site conditions (climate, source of energy, etc.), the level of information on the sustainability-related performance and its associated benefits.**

- **Investigating market responses**

**Different mechanisms may explain the extent to which sustainability benefits may translate in worth and market value. Owners may directly benefits from reducing operation expenses. However, in most other cases, the translation into financial value requires stakeholders benefiting from an improvement of sustainability performance to “reward” investors for these benefits. Some benefits may thus only be translated into added value for investors if the stakeholders concerned acknowledged the benefits either by rewarding them financially (higher rents for tenants, lower taxes for government, higher sale prices for other investors) or by at least showing a preference (reduced sale duration and vacancy, shortened letting period, increased asset marketability). Table 3 suggests some of the possible mechanisms at stake.**

**Table 3: Mechanisms impacting financial values**

| Driver | Mechanism | Stakeholders |
|---|---|---|
| Reputation | Brand value of the company<br>Corporate value (market performance) | Other investors<br>Contractors |
| Compliance | Risks associated to regulatory changes | Other investors |
| Access to capital | Access to preferential lending and insurance conditions | Insurance and banking companies |
| Tax conditions | Access to governmental grants and subsidies<br>Reduction of taxes<br>Ability to participate in CO2 trading schemes | Local authorities<br>Government |
| Operation license | Ease of obtaining permits for development projects<br>Permission to exceed existing planning restrictions (ex: in France, sustainable retrofits benefit for permits to develop on larger area ) | Local authorities |
| Expenses | Reduction of operation costs | Direct impact<br>Tenants |
| Rents | Increased rental value | Tenants |
| Letting conditions | Reduced sale duration<br>Shortened letting periods | Tenants<br>Other investors |
| Organisation performance | Portfolio optimization<br>Organisation efficiency | Direct impact<br>Other investors |

For each sustainability theme, different direct, indirect and potential impacts on value were thus listed to illustrate those mechanisms (see **Appendix 1**). Most of the mechanisms thus identified will not be reflected in market value and worth for investors. Mainly financial gains directly received by investors or indirect financial gains perceived indirectly by the investors as a reward in a bargaining with another stakeholder would be reflected in the market. This last situation would in particular encompass tenants who may accept to pay higher rents due to improved comfort conditions and reduced expenses.

This market response is not straightforward. Several elements may characterize the market response, in particular (see **Figure 6**):

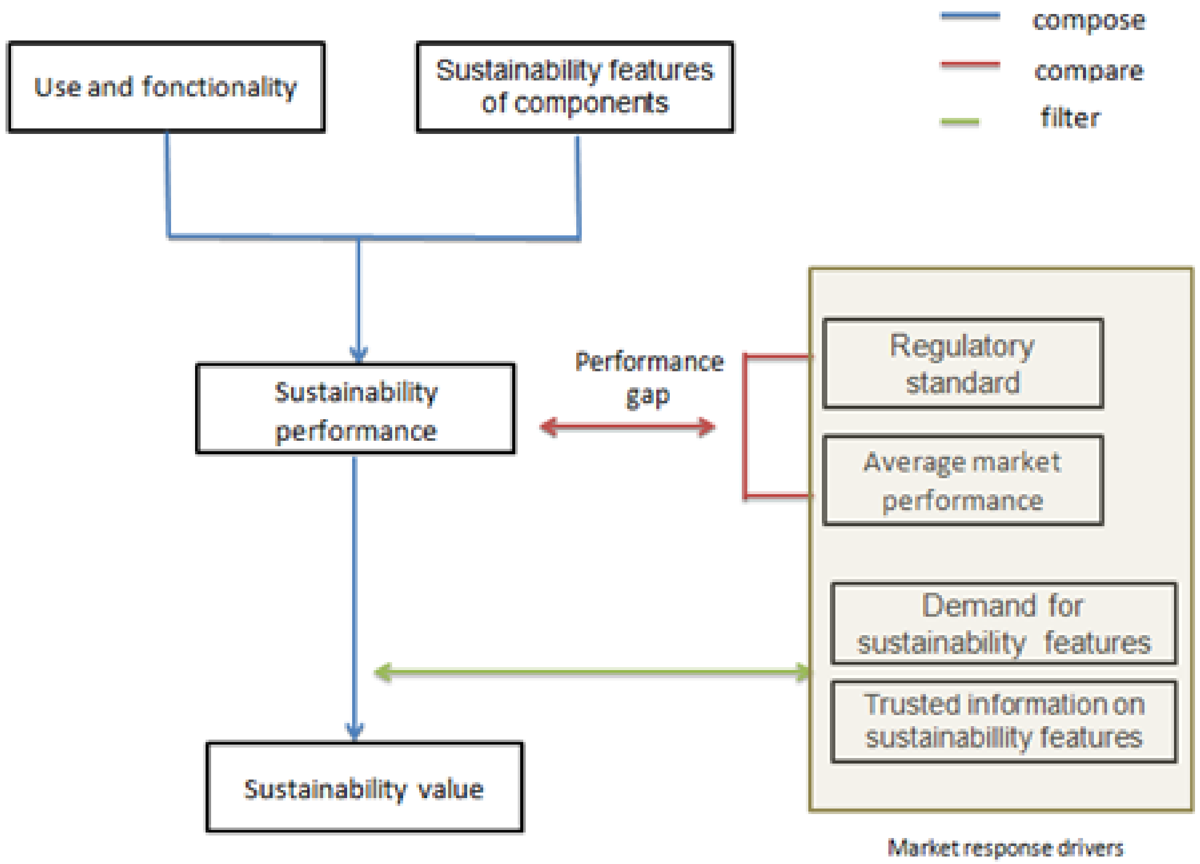



**Figure 6: Drivers of the market response from sustainability performance to sustainability value (source: Y. Kamelgarn)**

- **market standard as regards sustainability performance of buildings**. If there is already a large supply of sustainable buildings, sustainable characteristics will probably not result in higher financial value since the sustainability characteristics have become market standard. The added value that may be expected from sustainability features is thus correlated to the sustainability performance gap between the building being analysed and the market average. Several studies have indeed highlighted that the price premium for certified buildings tended to decrease with the increase in the supply of sustainable buildings (Chegut et al., 2014). In the future, the diffusion of certifications scheme could result in a decrease of price premiums for certified buildings. In addition, as sustainable buildings become the norm, the value of the existing stock could also be affected, through "brown discounts" for existing buildings with poor sustainability performance. Sustainability-related features would thus entail increased obsolescence for non-sustainable buildings (Reed and Warren-Myers, 2010).
- **the existence of a demand for sustainable features**. Sustainability will not be reflected in market value if it is not among the criteria considered by stakeholders. If tenants are not sufficiently interested in the sustainability performance of buildings or if the macroeconomic context is prevalent, they may not accept to pay higher rents for those characteristics. This situation could still result in an increased value for the investors (linked to the lower vacancy period between leases) but this value would be lower than what would have been observed otherwise.

- **information on the sustainability performance and its benefits**. A sufficient level of information on the benefits of sustainability features in buildings and a reliable measurement system of sustainability performance are required for stakeholders to account for sustainability features. This last condition could be met by agreed-upon certification schemes. Yet, to act as such, the current certification schemes need to focus more on providing harmonized metrics for the effective sustainability performance of buildings in use. The trust in the sustainability performance assessment appears paramount for the creation of a positive value chain with stakeholders rewarding investors investing in sustainability features.

## 1.5 In practice, a translation exercise

At a practical level, the identification of sustainability benefits and the mapping of the their impacts on various types of value including market value and financial worth correspond to a "translation" exercise with stakeholders involving four steps, as illustrated in **Figure 7:**

1. **Analysing the building characteristics**
2. **Assessing the associated sustainability performance according to the building context**
3. **Identifying various benefits of sustainability performance with stakeholders**
4. **Assessing potentials of value creation by analysing not only the financial benefits but also the non-monetary and potential values**

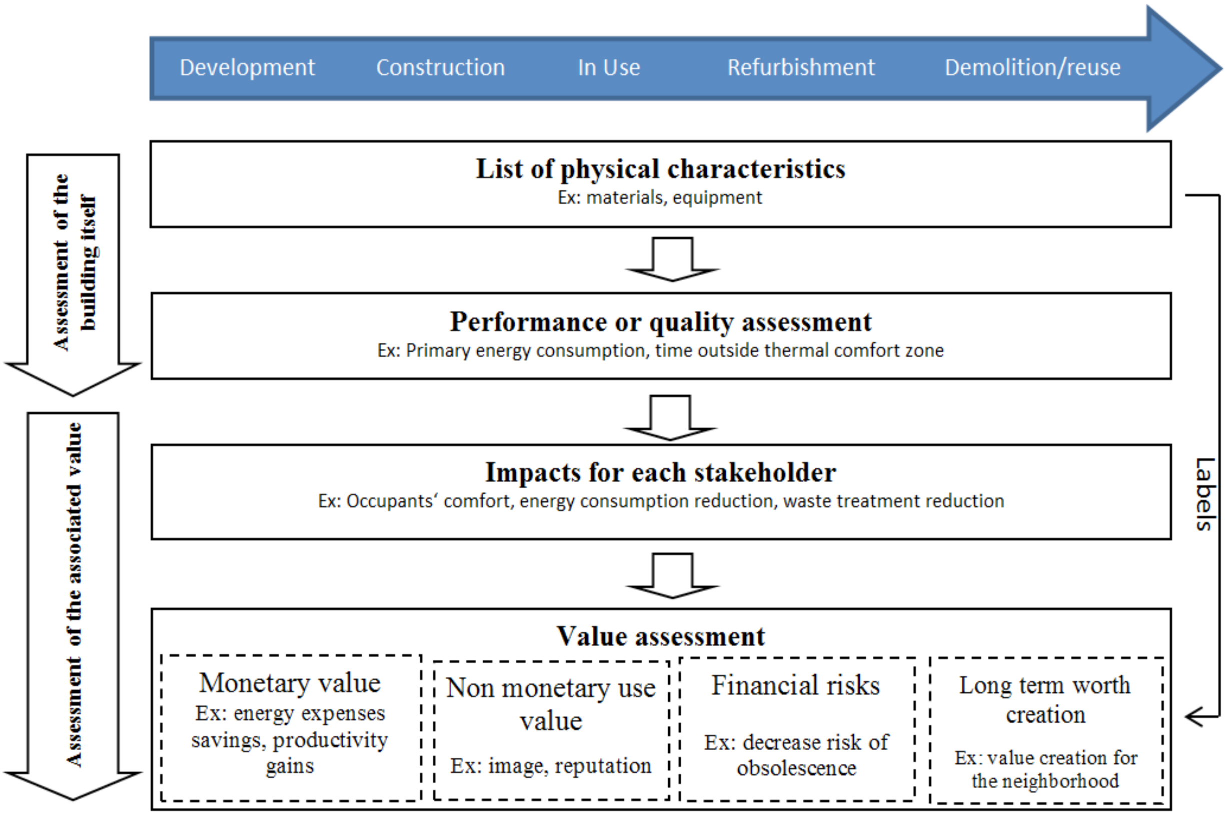



Figure 7 : From sustainability features to value

- **Analysing building characteristics in a systemic and holistic manner**

The starting point is a clear description of the building in a systemic manner. Sustainability-related features are part of the description of a building as a whole system. Traditional characteristics to describe buildings still apply, but need to be included in a new longer list of information incorporating sustainability-related features.

The development of building information modelling (BIM) should help the data collection required along the building life cycle.

As a first step, sustainability in buildings should be described through their different physical characteristics (location, integration in the local environment, functions provided to the occupants, energy installations, indoor air treatment installations, etc. These characteristics can in turn be translated into different metrics appraising the sustainability impacts of buildings (energy or water consumption, indoor air change rate, concentration of indoor pollutants, waste production, etc.). The UNEP FI's Metrics Report (2014) examines a core set of property characteristics and property indicators based on the standard ISO 21921-1 (or CEN TC 350 for a specific European application) from the International Organisation for Standardisation (ISO). See Appendix 2 for an overview of the CEN TC 350 standard.

- **Assessing building quality and performance**

This holistic description of building should help assess building performance. However, this would require further insights on the operation and market context. Indeed, sustainability performance is not the simple result of an analysis of the intrinsic quality of the building. It also depends on the quality of its operation (which largely depends on the facility manager) and the conditions of use and level of comfort. In addition, the assessment of sustainability performance requires being able to benchmark the performance of the subject property to the performance of the other similar buildings. **Performance is thus a subjective measure which is assessed against a standard, for example an average of the performance of existing buildings.** This assessment varies over time and space. For example, three years ago in France, an energy consumption of 150 kWhf/sqm was deemed acceptable. In 2014, such a figure would no longer correspond to a state-of-the art building.

In this regard, it seems important to foster the collection of raw data with information on the building conditions of use and operation. The development of applicable benchmarks could thus be used to qualify the quality and level of sustainability-related performance of buildings. Communicating this performance would thus require establishing a common format to present the data collected. Along these lines, several working groups have tried to establish building performance assessment cards, including the Building Passport developed by the Green Building Council or the Building Signature. See **Appendix 3** for further information on these initiatives.

- **Identifying impacts for stakeholders**

Next stage consists in translating this performance assessment into an appraisal of financial risks sand potential for value creation. The proposed approach is to identify the various different benefits associated with sustainability-related features through a dialogue with the concerned stakeholders. At this stage, all types of benefits must be considered, independently of their monetary nature.

Setting up working groups gathering different to reveal preferences and willingness-to-pay is not new in terms of academic studies. This methodology has already been used by Pivo (2008) to compare the materiality of the different sustainability themes or by Christensen (2012) to determine the impacts of sustainability topics in decision-making process. The underlying principle consisted in interviewing a panel of experts deem as representative of the different stakeholders (engineers, local authorities, private investors, asset managers, users, public investors) through a Delphi Method. This method was developed for interactive forecasting through an iterative process involving a panel of experts. Experts are asked to fill in a survey in several rounds. After each round, a summary of the previous answers are provided and the experts are asked to revise their earlier answers. This process facilitates the convergence towards a consensus but can also pinpoint the sources of strong disagreement.

In practice, this method could be adapted to the development of a discussion framework between investors and stakeholders to widen the understanding of value associated with sustainability-related features. A simple approach would consist in consulting a panel of representative stakeholders through an iterative process to identify their various potential benefits and assess relative preferences. Members of the panel would be asked to provide their perception of the various ways they could potentially be impact by a project and to rate the importance they attribute to each element in the shaping of a willingness to "reward" investors for the associated sustainability-related features.

- **Appraising the potential for value creation for investors**

The last step would focus on the direct and indirect benefits investors themselves can expect. The underlying principle would consist in completing an analysis as exhaustive as possible on opportunities to create mutual benefits with stakeholders. Four main types of benefits should be investigated:

1. **the impacts result in monetary gains for the building owner**. These gains may correspond to financial benefits directly received by the investors.

2. **the impacts result in direct but intangible gains for the building owner,** such as reputation gains.

3. **the impacts result in a reduction of the financial risks**, for example an higher exit yield link to lower obsolescence and higher resiliency to shifts in the regulatory context.

4. **the impacts result in a worth creation in the long term**, such as the indirect positive spinoffs on other stakeholders which over time could be translated into shared value creation with the investor.

To summarise, each sustainability-related feature will translate differently into monetary gains, potential risks and intangible benefits for investors according to the conditions of operation and use of the building, the stakeholders involved and the market context. Examining potential drivers and value creation channels on how the benefits for the various stakeholders can ultimately impact the investors could help better understand the impact of sustainability on financial values and improve the integration of sustainability-related features into investment decision-making process.

**Figure 8** describes a general framework through which sustainability-related features translate into market value and more globally could be integrated into investment decisions. The systemic description of buildings as well as the collection of information on their conditions of use and operation can be used to assess their sustainability-related performance and benchmark them against market standards. Then, a systematic listing of benefits for all stakeholders (owners but also tenants, users, local authorities and society at large) should be completed to gain an understanding of the total value generated by the sustainability-related features. This "total value" could be used as a tool for engaging with stakeholders and a separate parameter for investment decision-making process. Last, components of this "total value" influencing financial value should be integrated into market value and investment worth calculations as transparently as possible.

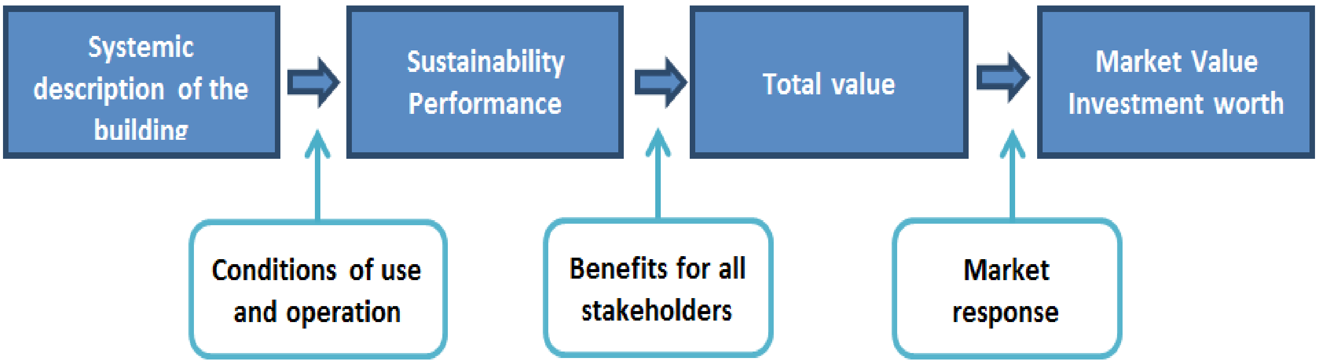



Figure 8 : Translation mechanism from sustainability features to market value

There is not straightforward formula to determine to what extent "total value" will translate into market value and worth. The adjustment factors in the financial input parameters (rents, occupations, letting duration, etc.) will depend on the market context and regulatory framework, the supply of sustainable buildings, the type of investors and users, the awareness on the potential benefits, the perceptions of the evolutions in the future expectations, etc. Next section aims to investigate this topic further from a more practical point of view.

# SECTION 2: CURRENT PRACTICES

This section examines to what extent companies integrate sustainability-related information into their investment calculations and valuations. We first question the type of sustainability-related information already being collected. Second, we investigate how they are currently accounted for in investment decisions. An emphasis is put on their integration into worth appraisals and valuation exercises since literature suggests that the translation into financial ratios would ensure a better integration of sustainability information into investment decision process. We focus on two main categories of players: in-house analysts and valuers.

This section relies on a literature review as well as on interviews conducted with valuers, consultants and in-house analysts. The interview guidelines presented in Appendix 4 was used. The key questions that were asked are:

- What is the investment decision / valuation system in place?
- What sustainability information is currently being integrated? What further source of information could prove interesting for investment process?
- How could this information be more transparently accounted for in a DCF-type calculation?
- How is uncertainty on the various parameters accounted for? How could it be presented in a more trans parent manner?

In addition, a workshop was organized with a sample of experts (investment, risk analysis, asset management, sustainability consultant…) to validate the framework and make suggestions for improvements. Results from the literature review and the interviews were thus presented to a workshop gathering 14 participants (see Appendix 5 for the workshop meeting minutes). After a brief presentation of the results of the first stage of the project, four main topics were discussed:

1. Collecting sustainability-related information,
2. Integrating sustainability-related information into a standardised DCF (discounted cash flow) framework,
3. Accounting for uncertainty on the reliability of the assessment used and the assessment of impact on market value,
4. Accounting for the flexibility and adaptability of the building design.

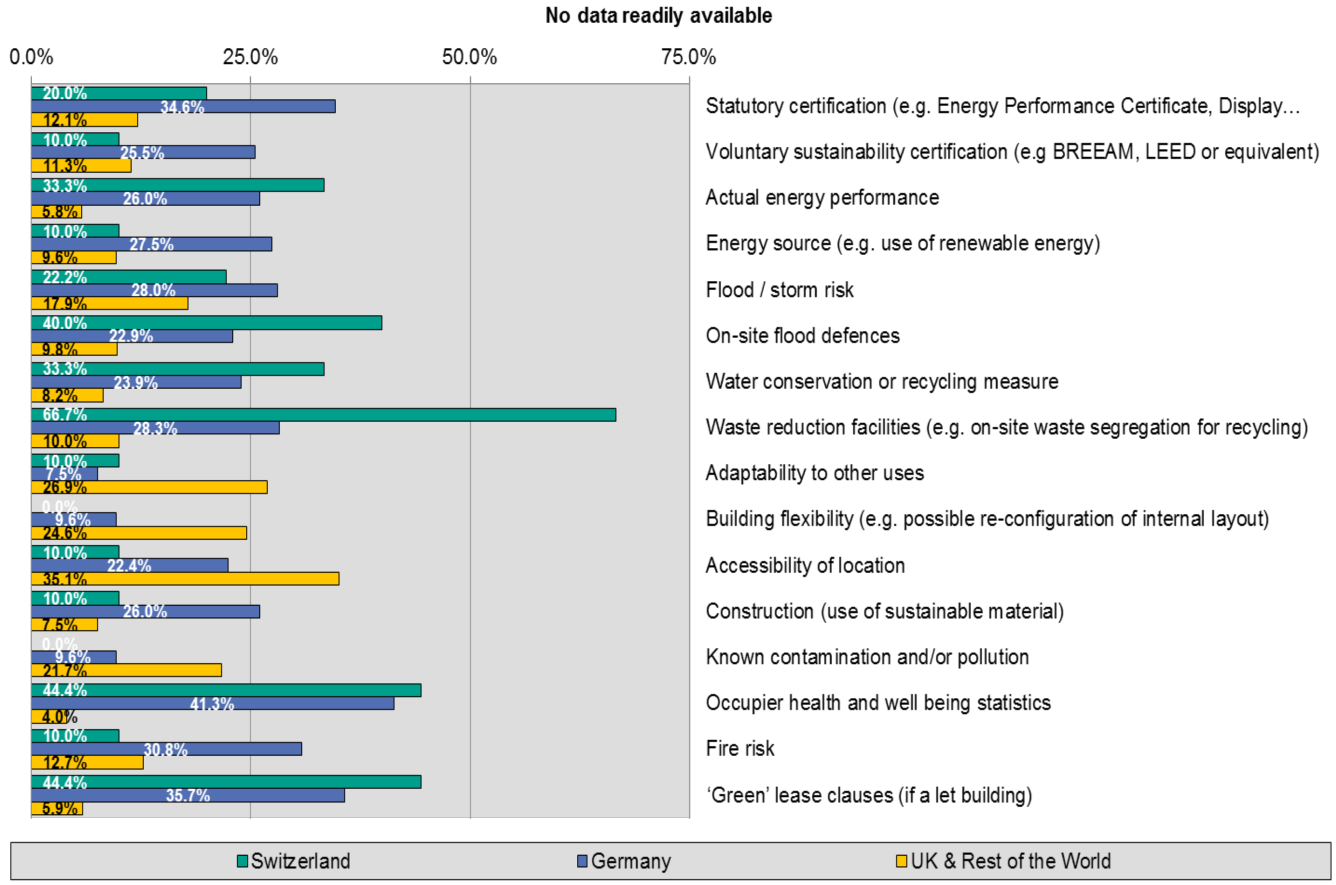
For each topic, a presentation of the preliminary findings was followed by questions to the panel on their practices and their feedbacks for practical recommendations.

## 2.1 Collecting sustainability-related information

As evidenced by different surveys (RICS survey among valuers , UNEP FI survey among investors ), a wide range of sustainability-related information is already being collected by leading companies. However information is still mainly collected on a punctual basis by third parties, with no systematic approach that could allow investors to integrate data collection into building management process.

- **Sustainability-related data collected by valuers**

The survey among 143 RICS members in Germany, Switzerland, United Kingdom and other world regions shows a growing number of valuers collecting sustainability-related data as part of their documentation of the building characteristics (Sayce et al., 2013). Among other issuers, valuers are asked about the sustainability aspects they perceive as having an impact on market value and topics they actually take into account for their assessments. Results suggest that valuers are increasingly aware of the impact of sustainability on market value in particular as regards voluntary sustainability certifications (BREEAM, LEED, BNB/DGNB or equivalent), adaptability and building flexibility. However, they still collect little sustainability-related information (see **Figure 9**) and there is no harmonised framework to integrate these data into valuations.




Source: Sayce, S., Lorenz, D., Michl, P., Quinn, F., and Lützkendorf, T., 2013, *RICS members survey on the uptake of VIP 13*, work in progress

**Figure 9: Responses to the RICS survey (Sayce et al., 2013) relating to data collection of sustainability-related information**

- **Sustainability related data collected by investors**

The survey among investors completed in the UNEP FI (2014)'s metrics report also highlights that a large number of sustainability-related information is already collected by leading investors. But respective data are not yet systematically captured and processed in decision-making process.

The survey was undertaken during the summer 2013 and was answered by a total of 54 organisations. It reveals that :

- **81% of the respondents have some form of "sustainability check"** or due diligence system in place. The type of information collected varies from one company to the next (see **Figure 10**). However, the authors note a shift in perceptions: "while the focus of attention has often been on mere energy-related issues in the past, the importance and relevance of almost the full breadth of sustainable building issues is now recognized and acknowledged." (UNEP FI, 2014, p.61).

- **56% of the respondents having a "sustainability check" in place use these checks during their financial decision-making process**. There appears to still be a gap between the collection of sustainability-related data and their actual use in asset management and investment decisions. This gap may be explained by the lack of standardised information system and the heavy reliance on third-party assessments as well as the weak applicability of sustainability checks for uses other than benchmarking.

- **58% of the respondents do not have any form of internal management system in place**. Most companies rely on third-parties for the collection of sustainability data and have not defined standardised process to collect sustainability-related information across all their portfolios.

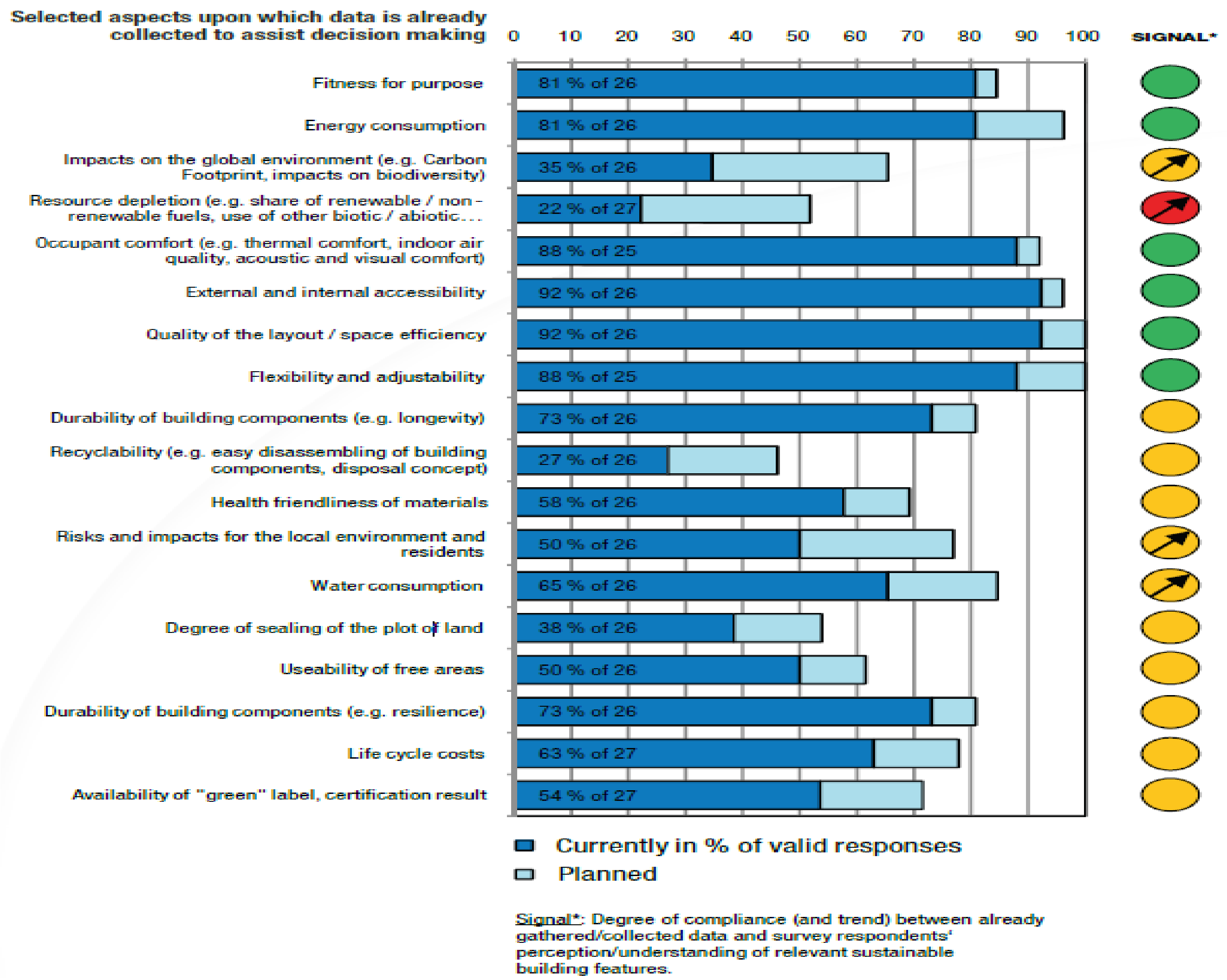



Figure 10: Responses to the UNEP FI's Metrics survey (2014) relating to data collection of sustainability-related information

- **Sources of information used by valuers and investors**

For investors, sustainability-related data are usually collected as part of the due diligence in place during a transaction (sale or purchase). Data are also sometimes collected during audits completed specifically to enhance portfolio knowledge during the holding period. Data collection is usually completed by third parties consultants.

The main sources of information used are:

- A building description involving a list of its physical characteristics and technical equipment,
- Legal technical documentation, including documentation on the environmental risks (asbestos, lead, etc.),
- Energy performance certificates,
- Raw consumption data or invoices from the facility managers or the tenants,
- Sustainability ratings from sustainability audits including Green Rating, IPD Eco Pas, etc.,
- Sustainability credentials from voluntary certification schemes when buildings have been certified (construction or in-use certification).

Data from sustainability ratings and credentials are still used in an aggregated manner since more specific details appear not readily usable for most investors. Sustainability-related data are still mainly collected on one-off basis (for transactions only or on a yearly basis by external parties) with no systematic approach that could allow investors to integrate data collection into building management process. The cost of systematic data collection would probably be lower than the costs of occasional due diligences requiring to start each time from scratch.

However, further initiatives to standardise the information collected for investment decisions exist. RICS Best Practice & Guidance Note for Technical Due Diligence (2011) outlines standard features that should be covered in technical due diligence (either for purchase, occupation or disposal purpose). The environmental and sustainability sections respectively detail desktop review, site investigation and external audits to identify potential environmental risks and health issues and appraise the building sustainability performance. The guide provides a minimum checklist to be documented by bodies undertaking the due diligence technical assessment. RICS Guidance Note on Sustainability and Commercial Property Valuation (2013) also contains a sustainability checklist with type of information that valuers should collect when feasible in the scope of their valuation. It encompasses information on location, on the land site, on the building condition, configuration and equipment including sustainability features and on the availability of building technical documentation.

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## 2.2 Integrating sustainability into decision-making process

Although investors, valuers and analysts increasingly acknowledge the impact of sustainability-related features on market value, there is no standardised framework to integrate the information collected into investment calculations and valuation exercises.

- **Investment decision context and value**

During investment decision-making process, various models may be used (risk assessments, asset allocation models, worth and value calculations, etc.). The respondents to the UNEP FI's metrics survey (2014) indicate that their predominant decision-making parameters are the selling / purchase price, the return on investment and the total return. Valuations are thus one of the models on which investment decisions are based. They may concern different types of value: value in exchange (market value) and value in use (worth) (French, 1997). Market value is mainly used for investors wishing to sell their asset, whereas worth is better suited to long term detention. In particular, the public sector more frequently relies on worth appraisals, which offer more freedom to better integrate a wider range of considerations.

According to traditional literature on real estate investment decisions (French and French, 1997), investors compare current prices with their internal forecasts and motivations for purchasing (anticipation that prices will go up, belief that refurbishment could help the building perform better, etc.). A decision to sell should occur when the investor considers the market price to be lower than its own assessment of the property worth. However, other parameters may also influence decision such as concerns about what other actors are doing (mimetic behaviour), capital or liquidity constraints, investors' perception of market trends, etc.

- **Main valuation methodologies**

Different value assessment methodologies exist (Pagourtzi et al., 2003; RICS, 2014). The main traditional valuation methods are:

- **Comparable sales method:** This method relies on the identification of comparable transactions with buildings with characteristics similar to those of the building analysed. Valuers thus make adjustments to reflect the remaining differences between the comparable buildings and the building being assessed. This method is mainly adopted to assess the value per square metre. It is quite simple but requires a large transaction database. In addition, it takes account of market changes with a lag. In addition, while the building characteristics are listed in the valuation report and are used to choose the comparables, there is no transparent accounting of the impacts of the building characteristics in the determinants of the value.

- **Investment method / Income capitalisation approach:** This method relies on the capitalisation of the income produced by the building being assessed (net rental value usually assessed by comparable methods) using yields also estimated with comparable transactions. This method is quite simple but still fails to transparently account for shifts in the context.

- **Replacement costs method:** This method is usually used for properties seldom sold in the market (hosting a specific activity for example) or for buildings at their end of their lifespan. The valuers assess the market value of the raw land and add the reconstruction cost for a similar building before making adjustment for obsolescence and depreciation.

- **Discounted cash flow (DCF) method**: This method is **based on an estimation of the net present value of the cash flows** generated by the building. The valuers appraise the future cash flows over a specified time horizon (usually 10 or 15 years) including rents, operation costs, reletting costs, etc. These cash flows are actualised using a discount rate taking into account a risk premium. An exit value corresponding to the sale value at the end of the specified time horizon is added.

$$DCF=\sum_{t=1}^{T}\frac{CF_t}{(1+t)^t}+\frac{Exit\ Value_T}{(1+r_e)^T}$$

Among other authors, Muldavin (2009) and Lorenz and Lützkendorf (2011) have advocated the use of discounted cash flows methodologies to better integrate sustainability-related information as they enable valuers to be more transparent about how they take into considerations building features for each input parameter. Three types of input parameters (market value drivers) can be distinguished:

- Income-related parameters including rents, rental growth, letting duration, exit yield, exit value,
- Expenses related parameters including operation expenses (maintenance costs, minor repairs, etc.), capital expenses (major refurbishment costs), obsolescence and depreciation,
- Model parameters including inflation rate.

- **Current level of integration of sustainability-related information in valuation**

Valuers and investors now widely acknowledge that sustainability-related information - in particular refurbishment costs, sustainability certification schemes and labels or building flexibility and adaptability - has an impact on asset value. However, sustainability is still often perceived as a separate topic. In most cases, valuers and investors mainly take account of the three following sustainability-related topics:

- **Presence or absence of a sustainability credential** which is assessed as another separate building characteristics. It is perceived as an additional value in markets where certification schemes have not yet widely spread or merely as preventing discount in markets where certification credentials have become standards.
- **Provision for refurbishment** costs associated with energy upgrades which assessment is based on clients (investors) documentation.
- **Environmental risks** which have traditionally been examined as part of compliance checks.

Resulting adjustments in the assessment of market value drivers mainly consists in accounting for retrofit costs in capital expenses, including more detailed energy bills in operation expenses, higher rents and shorter vacancy periods. The type and level of adjustments performed are still heterogeneous. The 2013 RICS survey (Sayce et al., 2013) illustrates the multiple adjustments possibilities considered by active valuers. As presented in Figure 11, most valuers mainly account for energy certificates and sustainability certification through a single adjustment on either the rental level or the yield.

More precisely, most valuers estimate each single input parameter by adjusting figures from comparable property assets and indices according to the specific characteristics of the subject property. The following sources of information are typically used:

- **Building characteristics** with information collected onsite or through regulatory documentation. Environmental risks are usually included in this documentation.
- **Transaction data on comparable assets**: Each valuer gathers data on transactions to compile a transaction database from which comparables can be identified. The presence of a certification scheme is now widely accounted for in the identification of comparables.
- **Benchmarking ratios**: For some inputs such as maintenance and repairs costs, generic ratios are also used. They may be adjusted according to the building characteristics if the building performs differently from the market standard or if more accurate information is available.
- **Information asked to investors themselves**: Valuers usually ask investors about their expected return and holding period so as to calculate the discount rate. In addition, they require investors to specify project characteristics when refurbishment works are planned. In this case, provisions for refurbishment costs are then integrated into the assessment of future cash flows.
- **Forecasts**: Valuers also assess market expectations on future trends using market indices and forecasts on time series. The underlying principle is to examine market context and identify anticipations on the future importance of sustainability credentials. Along these lines, data provider IPD has published green indexes specific to sustainable properties.

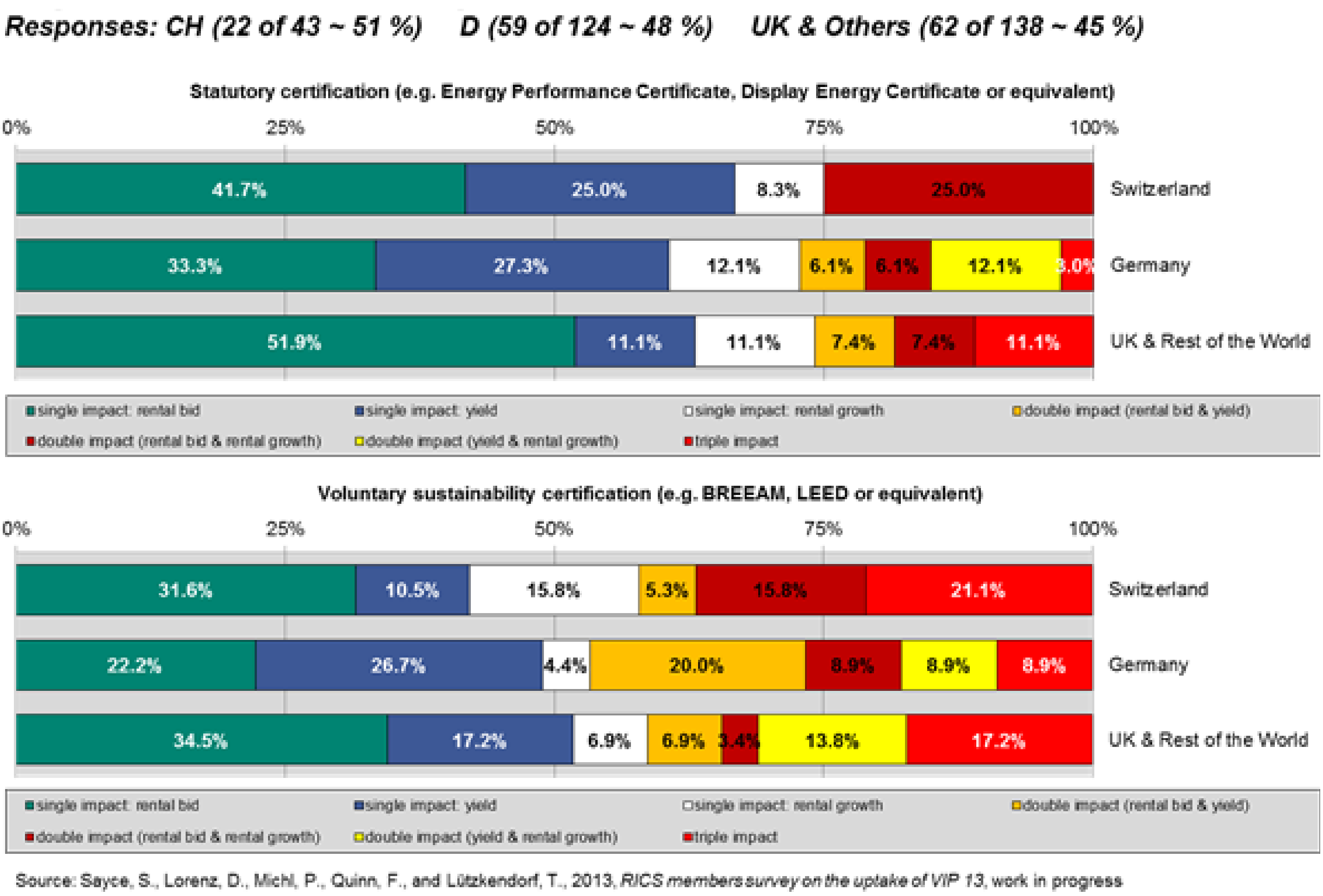


**Figure 11: Responses to the RICS survey (Sayce *et al.*, 2013) (Sayce et al., 2013) relating to impact on valuation inputs**

In a nutshell, the long list of information on technical data, physical design and individual sustainability-related features of buildings is not commonly used in the valuation exercises. The absence and presence of a sustainability certification (BREEAM, LEED, HQE or equivalent) is usually used without consideration of the effective sustainability performance of the building in use. The certification profile and the year of the certification are scarcely mentioned although they could provide a first step in discriminating between certified buildings. In particular, a clear distinction should be made between the brand value associated with the mere presence of a certification scheme and the effective value associated with the deeper analysis of the sustainability performance itself.

- **Position of professional valuation bodies**

Since 2007 with the Vancouver valuation agreement, professional valuation bodies, including the RICS and the US Appraisal Institute, committed to working towards the integration of sustainability issues into valuation practices. Over the following years, there has been a gradual shift among professional valuation bodies for a deeper incorporation of sustainability-related information in valuations.

In 2009, the RICS published its first paper on valuation and sustainability, RICS Information Valuation Paper N°13. This note contains general advice for valuers on the incorporation of sustainability-related information. It recommends that valuers only take account of sustainability in valuation exercises if there is evidence that the market differentiates between sustainable and non-sustainable properties. However, it also suggests undertaking more detailed analysis on sustainability issues so as to advise investors on the impacts they could have in the future.

In its second paper on valuation and sustainability published in 2013, the RICS went one step further. This note recommends that valuers collect sustainability-related data and inform their clients on the sustainability performance of properties and how it could impact the value and risk profile of assets. In particular, it states: "While valuers should reflect markets, not lead them, they should be aware of sustainability features and the implications these could have on property valuers in the short, medium and longer term." Valuers are thus required to:

- Gain understanding on the assessments of sustainability performance
- Collect sustainability-related information as part of their investigations and consider unavailable information as potential additional risk factors,
- Assess sustainability-related characteristics beyond the absence or presence of a certification scheme,
- Reflect sustainability-related characteristics in the value appraisal.

These practices have now been made explicit in the 2014 edition of the RICS Valuation Standards which advise valuers to "assess the extent to which the subject property currently meets sustainability criteria and arrive at an informed view on the likelihood of these impacting on value, i.e. how a well-informed purchaser would take account of them in making a decision as to offer price, […]."(RICS, 2014, p. 59-60).

At national level, practical guidance has also evolved. In France, the fourth edition of the valuation charter ("Charte de l'expertise en évaluation immobilière, 2012") proposed for the first time a section dedicated to sustainability issues and underlined the necessity to account for labels and sustainability credentials in valuation exercises. Among others, the charter recommends valuers to:

- better be informed of sustainability standards,
- complement the list of information already collected with data on sustainability credentials, results from environmental audits and budgets planned for refurbishment works,
- express reserves as regards the quality of sustainability-related information,
- identify potential value creation associated with sustainability upgrades,
- Account for the impact of sustainability-related features when relevant.

- **Current level of integration of sustainability-related information into asset management decisions**

As regards refurbishment investment decisions, payback ratios are still the main calculation tool considered. Investors merely account for the added costs associated with the sustainability-upgrades and the lower expenses associated with the reduction of energy consumption. Since the cash flows are usually calculated using a discount rate, the savings hardly offset the upfront investment cost, resulting in under investment in sustainability-related features.

This report that payback calculations are a misleading tool. They do not inform on the impacts on value and fail to account for benefits beyond energy savings.

- **Existing initiatives promoting further integration**

Several research projects and professional initiatives have been specifically dedicated to integrating sustainability-related criteria into investment decision-making process. Table 4 lists some initiatives undertaking to offer a more standardised framework for the integration of sustainability-related information into investment decisions and valuations. Four main types of approaches can be distinguished s.

- **Risk documentation and separate qualitative section** within the valuation report to pinpoint potential impacts on value that are not yet reflected in the market as well as risks (or benefits) associated with the sustainability-related characteristics of the subject property.
- **Lump sum adjustment on the final result**: This method is simple but introduces a risk of double counting since some parameters already incorporate sustainability issues.
- **Lump sum adjustment on the input parameters**: Meins et al. (2010) created an Economic Sustainability Indicator (ESI) they integrate in the discount rate of a standard value calculation in addition to the property risk. The ESI is calculated using a weighted average of building ratings on five key sustainability criteria and experts' appraisal on the importance of each criterion as regards potential future impacts on value. Ellison et al. (2007) also focus on building "future-proofness" as regards evolution of the market uptake of sustainability. As opposed to the ESI, the investors themselves are required to appraise the resiliency of buildings against future changes.
- **Integrated approach with qualitative integration of sustainability characteristics.** Valuers need to be trained on sustainability topics to embed the analysis of the sustainability-related characteristics within their estimation of single input parameters. Discounted Cash Flow (DCF) approach is favoured by most authors including Muldavin (2009), Lorenz and Lützkendorf (2011) and UNEP FI (2014). To increase robustness and transparency, Austin (2012) suggests a practical procedure for valuers to systematically collect sustainability information and account for its impacts on value. Runde and Thoyre (2010) propose their own valuation procedure. They recommend analysing the market sustainability context (regulation framework, supply of certification schemes and the demand for sustainable features...) to categorize the sustainability performance of properties according to their sub-market sustainability context.

Ultimately, authors agree that no pre-established figure can be used. The integration of sustainability into value appraisals needs to be completed distinctly for each building according to the property characteristics and the type of market it belongs to. DCF framework appears particularly adapted to this task since it enables analysts to transparently report how each input parameter is impacted by the sustainability performance of the building. Along these lines, this report strongly recommends the use of the DCF methodology to account for sustainability in a transparent manner. See **Appendix 6** for an illustration on how sustainability features could impact DCF input parameters.

The key challenge is thus to understand how sustainability-related features benefit the owner and his stakeholders, and how it will be potentially reflected through market mechanisms. For Runde and Thoyre (2010), "the most effective way to deal with an evolving market influence, especially one that is changing rapidly, is to understand the concepts that drive it". Similarly, Warren-Myers (2012) concludes that valuers will be able to form their own integration of sustainability once they are educated on the sustainable real estate and its effects on the market.

Table 4: List of initiatives on the integration of sustainability-related information into investment decision process and/or valuation

| Project name/ article reference | Period | Coun-try | Type of value | Key content |
|---|---|---|---|---|
| **The Sustainable Property Appraisal project**<br><br>Sayce, S; Ellison, L.; Smith, J. | 2004 -2007 | UK | Worth (investor) | Appraisal system for investors. It consists in three separate tools: a future proofing property questionnaire which set a framework for investors to assess the risks associated to poor sustainability performance; the sustainability Appraisal Tool using the questionnaire results as inputs in a DCF calculation framework; a pilot Sustainable Property Investment Index. |
| **Environmental value added**<br><br>Masato Ito<br>Sumito Motrust | 2005-present | Japan | Worth (investor)/ Market Value | Analysis of the added value from sustainability which is defined as the net income increase and the cost reduction between sustainable and non-sustainable properties. The use of environmental ratings is advocated as a support for the calculation of the added value. In particular, the project discusses possibility to connect real estate value appraisals to CASBEE rating system. |
| **Value Beyond Cost saving**<br><br>Green Building Finance Consortium (USA) | 2006-present | USA | Worth (investor) | Suggestions on how to adapt existing appraisal tools such as the discounted cash flows to integrate sustainability issues transparently in the model inputs. It reaches beyond costs considerations (energy savings) to integrate broader impacts on value. On the whole, it reckons that no new methodologies are required but advocates a deeper understanding on how sustainability performances can affect tenants and how investors perceive the value of these features according to the market context. |
| **ESI-Property valuation**<br><br>Meins, E., Wallbaum, H., Hardziewski, R., Feige, A | 2007-present | Swit-zerland | Worth (investor)/ Market Value | Proposition of methodology to integrate risks linked to poor sustainability performance due to future market shifts and regulation developments. The approach stems from the belief that sustainability is difficult to account for since its value varies according to market trends, whereas traditional valuation methods suffer from market lags. The ESI (Economic Sustainability Indicator) is constructed as follows: property is rated against five key sustainability criteria. Experts' diagnosis on the potential impacts on value for different probabilised scenarios is used to weight each criterion. The resulting ESI Indicator is thus integrated in the DCF method in the discount rate as an addition to the property risk. |
| **RICS Valuation Information Paper N°13**. | 2009 | Europe | Market value | Guidance note for valuers. It recommends valuers to integrate sustainability issues in their value calculations only if there is evidence reflected in the market. |
| **Immovalue project** | 2008 - 2010 | Europe | Market value | The project inventories approaches and methodologies on how new developments such as EPC/EPBD as well as life-cycle costing (LCC) and analysis (LCCA) could be integrated in property valuation. |

| | | | | |
|---|---|---|---|---|
| **Integrating Sustainability and Green Building into the Appraisal Process**<br><br>Runde, T. Thoyre, S. | 2010 | USA | Market value | Proposition of a three-step valuation model for real estate valuers. First step consists in assessing the market uptake of sustainability (importance of sustainability topics for the different stakeholders in the market). Second step consists in analysing the subject property using a sustainability risk matrix provided in the article. The subject property is thus positioned according to its sustainability in relation to the market standard and uptake. Last step consists in monitoring the evolution of the demand and supply of sustainable properties (resulting in sustainable property liquidity) over time. |
| **IPD Eco Pas** | 2012-present | Europe | Risk | Benchmarking service to identify environmental risks for a given property and compared it with peer exposures. Data are collected according to a Valuer Sustainability Checklist developed in partnership with the RICS. This checklist is used to complete the risk analysis and compare it with peer thanks to a database with environmental data and capital values for different properties type. |
| **Sustainability and Income- Producing Property Valuation**<br><br>Austin, G.W. | 2012 | North America | Market value | This paper provides a systematic practical procedure for evaluating sustainable property. The underlying principle is that appraisers should systematically collect building information on sustainability as well as market context information on sustainability so as to adjust traditional input parameters. The uncertainty associated with the procedure is assessed through a sensitivity analysis using Monte-Carlo simulations. |
| **RICS Sustainability and commercial property valuation**. 2nde edition<br><br>Sayce, S., Quinn, F. | 2013 | Europe | Market value | Guidance note for valuers, updating the note n°13 published in 2009. The guidance note encourages valuers to gather information on a sustainability checklist, assess their impact on value and integrate them in value calculation if reflected by the market and provide advices to their clients on sustainability issues beyond current market integration. |
| **Integrating value and uncertainty in the energy retrofit analysis in real estate investment.** Bozorgi, A. | 2013 | Europe | Worth | Through an extensive literature review, interviews with real estate experts, and the author's experience with energy efficiency analytics and tools development, this paper suggests a systematic value-based assessment process to analyse full costs and benefits associated with energy retrofit options in the context of value, while clearly articulating the risk and uncertainty. The outcome of the proposed process enables users make more informed investment decisions and drives major energy retrofit investments. |
| **How to calculate and present deep retrofit value**<br><br>Rocky Mountain Institute. Bendewald, M., Hutchinson, H., Muldavin, S. Torbert, R | 2014 | USA | Worth (Owner -occupier) | Guide providing practical guidance for owner occupiers as to how value deep retrofits beyond the mere costs savings. They define «Deep retrofit value is the net present value of all of the benefits of a deep energy or sustainability investment.» Methodologies incorporate risks analysis and considerations to properly avoid double counting. Nine discrete value elements are considered: 1. Retrofit Development Costs ; 2. Non-Energy Property Operating Costs ; 3. Retrofit Risk Mitigation; 4. Health Costs ; 5. Employee Costs ; 6. Promotions and Marketing Costs ; 7. Customer Access and Sales ; 8. Property-Derived Revenue; 9. Enterprise Risk Management/Mitigation |

| | | | | |
|---|---|---|---|---|
| **Renovalue**<br><br>Renovalue consortium | 2014-present | Europe | Worth (Owner -occupier) | Training material for valuation professionals on sustainability features and their impacts on value drivers (rent, discount rate, capital expenditures, maintenance costs, etc.). The project stems in the belief that there is no automated formula to integrate sustainability into valuation process. Training valuers to account for sustainability as part of their daily assessment of buildings feature thus appears paramount. |
| **Sustainability issues in the valuation process of project developments.**<br>Fröch, G. | 2015 | Europe | Market value | System to incorporate the economic benefits of sustainability into the valuation of real estate project developments. Using a catalogue of parameters, key parameters are identified for the specific project development to be valued. These parameters are then quantified by means of distribution functions and checked for interdependencies. This analysis, and with it the results of a sustainability valuation, are incorporated into the calculation of the market value and the internal rate of return. Results are communicated according to the input data through distribution functions. |

Based on the analysis of previous initiatives, this report recommends the use of a DCF methodology to account for sustainability performance and its impact on value. The integration should clearly state which sustainability-related characteristic has been considered and how it has been integrated into the DCF input parameters. In case sustainability performance could not be documented, the worst (or at least average) performance should be assumed. Information accuracy and associated uncertainty should be properly dealt with. Next paragraph discusses how this uncertainty could be accounted for.

## 2.3 Accounting for uncertainty

The integration of sustainability into valuations and investment decisions is fraught with uncertainties. Accounting for uncertainty and better inform investors on the risk return profile of real estate assets. It is also is paramount to ensure trust in the DCF methodologies and results. “When incorporating sustainability-related risks and opportunities into a DCF model, it is very important to use a set of ranges for potential adjustments to DCF input variables. This will help to avoid the impression of unrealistic levels of precision.” (UNEP FI, 2014, Sustainability Metrics Report, p.85)

In addition, accounting for uncertainty may enable investors and valuers to examine resiliency against future changes in the context. A flexible building design represents a means to mitigate some of the risks posed by these shifts. Flexible technical solutions allow investors to better adapt the building to shifts in occupiers’ preference. Similarly, flexible indoor layout enables investors to better answer shift in occupiers’ needs thus improving building future-proofness.

- **Uncertainties associated with sustainability**

Two types of uncertainties associated with sustainability may be distinguished:

- **Uncertainty related to the sustainable performance assessment**. Sustainability-related information is not always available. In the absence of specific data, generic ratios may be used to estimate the various parameters concerned. This results in uncertainty on the building quality and sustainability performance. Even in the presence of information, the assessment may not be accurate since various factors (local conditions, users‘ behaviours, quality of technical maintenance) need to be accounted for to understand sustainability performance.

- **Uncertainty related to the effective impact of sustainability performance on value**. At a given time, the impact of sustainability performance on value will vary according to the type of investors and tenants, the market conditions, the legal context, the evolution in the supply and demand of sustainable buildings, etc. **Table 5** lists some examples of uncertainties associated with the impact of sustainability performance on financial value.

Table 5: Examples of uncertainties associated with the impact of sustainability on value

| | |
|---|---|
| **Market uncertainties** | - Market sentiment on sustainable properties (impact on rent, letting duration, exit yield, etc…)<br>- Evolution of the utility prices (energy, water, waste management, etc.)<br>- Evolution of the supply and demand of sustainable buildings |
| **Technical uncertainties** | - Installation remaining lifespan<br>- Evolution of the replacement costs of components<br>- Technological developments<br>- Performance of the building |
| **Future use uncertainty** | - Evolution in the users need<br>- Capacity of the building to adapt to new functions |
| **Legal uncertainties** | - Evolution of the regulatory context on sustainability issues<br>- Evolution of the building code<br>- Introduction of new taxations for pollution/ GHG emissions/ resource depletion |
| **Environmental conditions uncertainties** | - Adaptation to the consequence of climate change (thermal comfort in summer, flooding and storm risks, etc.)<br>- Adaptation to extreme climatic events |

- **Uncertainties in current practices**

Interviews conducted for the project and the discussion with experts during the workshop suggest that uncertainties are usually not dealt with in current practices. In most advance cases, uncertainty is an ad hoc exercise based on the identification and assessment of various scenarios that could impact value. There is need for better tools to account for uncertainty.

- **Position of valuation professional bodies**

Expressing uncertainty in valuation is a long standing issue (French and Gabrielli, 2005). In 1994, the Mallison working group produced a report "outlining a number of initiatives that the RICS should undertake to help improve the standing of the valuation surveyor" in particular as regards uncertainty. These recommendations were addressed in the RICS Carsberg report in 2002. This report highlighted the need for expressing uncertainty, in particular when data are insufficient, so as to improve the decision-making process. The report led to the launching of a consultative process and the introduction of Guidance Note n° 5 in the 2003 edition of the RICS Appraisal and Valuation Standards. Three ways to express uncertainty to the clients are considered:

- verbal reporting (declarative in the report),
- ranking to translate the risk of variance of the output,
- statistical distribution (use of statistical information).

In order to report uncertainty to clients, the use of a distribution in addition to the traditional single valuation figure appears as a means to enhance the reputation of the valuation profession and to provide helpful insights for risks assessment. Monte-Carlo simulations, a probabilistic tool used to compute results on probabilised scenarios and sensitivity analysis, have been presented as the simplest uncertainties on the different key input parameters affect the risk profile of the final appraisal result.

The RICS 2014 Red Book clearly emphasis the presence of uncertainties inherent to valuation exercises. In particular, it states: "A valuation is not a fact, it is an opinion. The degree of subjectivity involved will inevitably vary from case to case, as will the degree of certainty – that is, the probability that the valuer's opinion of market value would exactly coincide with the price achieved were there an actual sale at the valuation date. Ensuring user understanding and confidence in valuations requires transparency in the valuation approach and adequate explanation of all factors that materially affect the valuation." (RICS Red Book 2014, p. 120) In the dedicated guidance note, valuers are thus strongly advised to comment on issues affecting the uncertainty of the calculation in the valuation report and to include sensitivity analysis on key assumptions.

- **Existing initiatives to better account for uncertainty in valuation exercises**

Among others, Lorenz and Lützkendorf (2011), Austin (2012) and Stein et al. (2014) recommend assessing the uncertainty of valuation exercises through a procedure using Monte-Carlo simulations. They also advocate its use to assess the sensitivity of the adjustments due to the integration of sustainability-related information.

Several distributions can be used for the parameters. Most articles recommend the use of triangular distributions for input parameters, which require valuers to provide worst case and best case scenario (French and Gabrielli, 2005). This method is quite simple. Another advantage is that this approach resembles the heuristic process implemented by valuers with the use of best case, worst case and best guess scenarios

- **Use of Monte-Carlo simulations to account for uncertainty**

Monte-Carlo simulations correspond to an iterative process to compute results from probabilised situations. For each simulation, inputs are randomly chosen among a pre-defined distribution to generate an output figure that is recorded. This process is repeated a very large number of times to generate a distribution for the output. Valuers thus obtain a range of outputs which can be characterized though mean, median, standard deviation, skewness (degree of asymmetry) and kurtosis (degree of flatness).

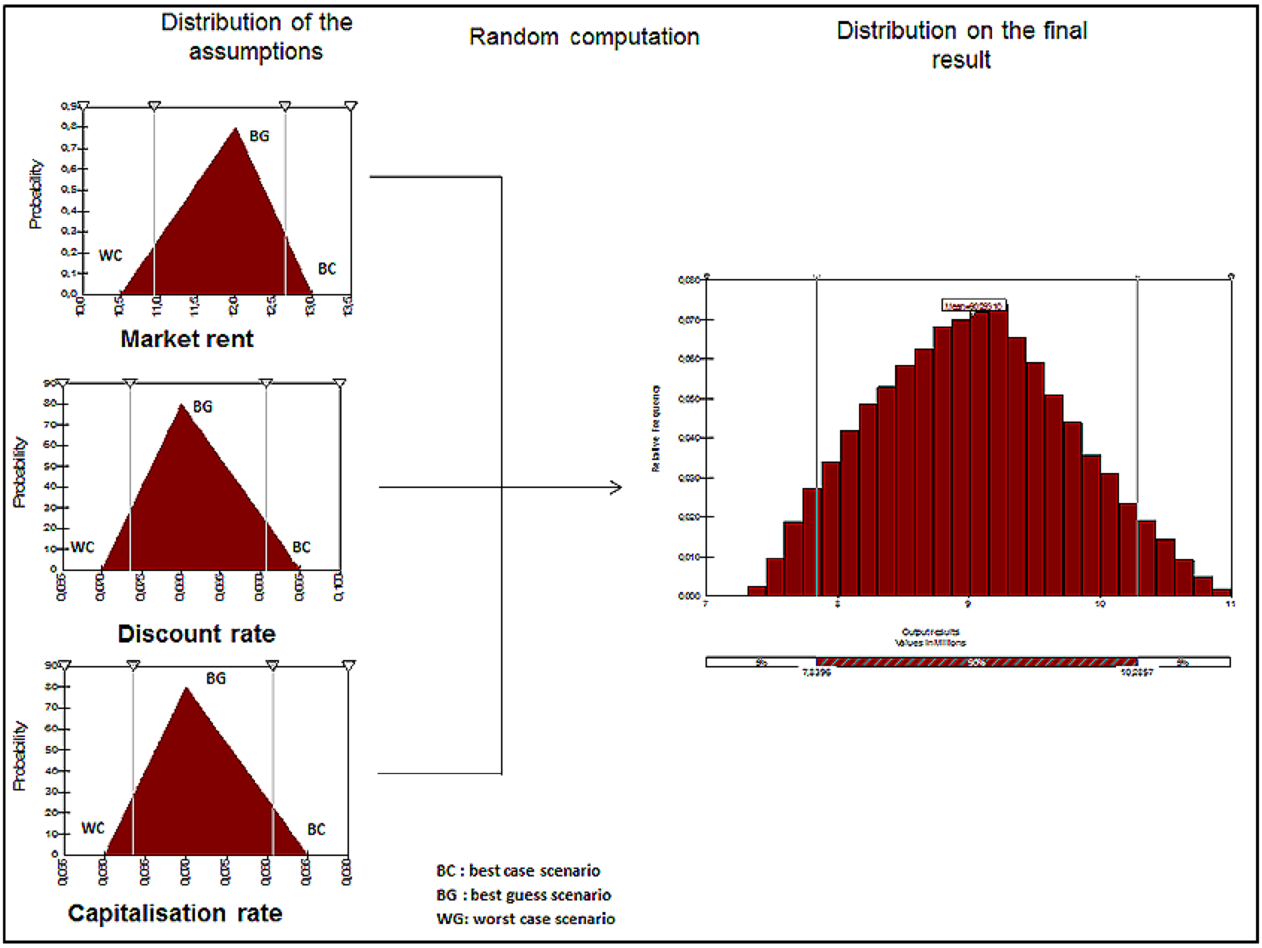


**Figure 12: Illustration of the principle of Monte Carlo Simulations** (source: D. Lorenz)

- **Monte Carlo Simulations case study 1**

This case study compares the value a standard building to the value of a similar sustainable building (upgrade scenario for example). **Table 6** presents the hypothetical assumptions that are used to calculate the market value using a DCF calculation. The underlying principle is that sustainability is liable to affect market rent, as well as discount rate, capitalisation rate as well as letting fee and duration. The figures proposed are merely illustrative. Resulting DCF calculations suggest a market gap of 12.74% between the standard building and its “sustainable” equivalent.

**Table 6: Example of input assumptions for a DCF calculation** (source D. Lorenz)

| Main inputs / assumptions | Standard building (1a) | Sustainable Building (1b) |
|---|---|---|
| Market rent (m²/month) | 12 € | 12,50 € |
| Actual/current utilities (m²/month) | 2,40 € | 2,00 € |
| Maintenance (m²/year) | 5,00 € | 4,50 € |
| Letting time space Y | 6 months | 3 months |
| Letting fee space Y | 3 monthly rents | none |
| Letting time space Z | 12 months | 6 months |
| Discount rate | 8,00% | 7,75% |
| Cap rate | 7,00% | 6,50% |
| | | |
| Present value | **9.234.016** | **10.410.182** |
| Change/Difference (total) | | 1.176.166 |
| Change/Difference (in %) | | 12,74% |

Using triangular distribution assumptions for market rent, capitalisation rate and discount rate, Monte-Carlo simulations are thus used to also compare the distribution profile accounting for uncertainty on the underlying assumptions. **Figure 13** displays the results from this computation.

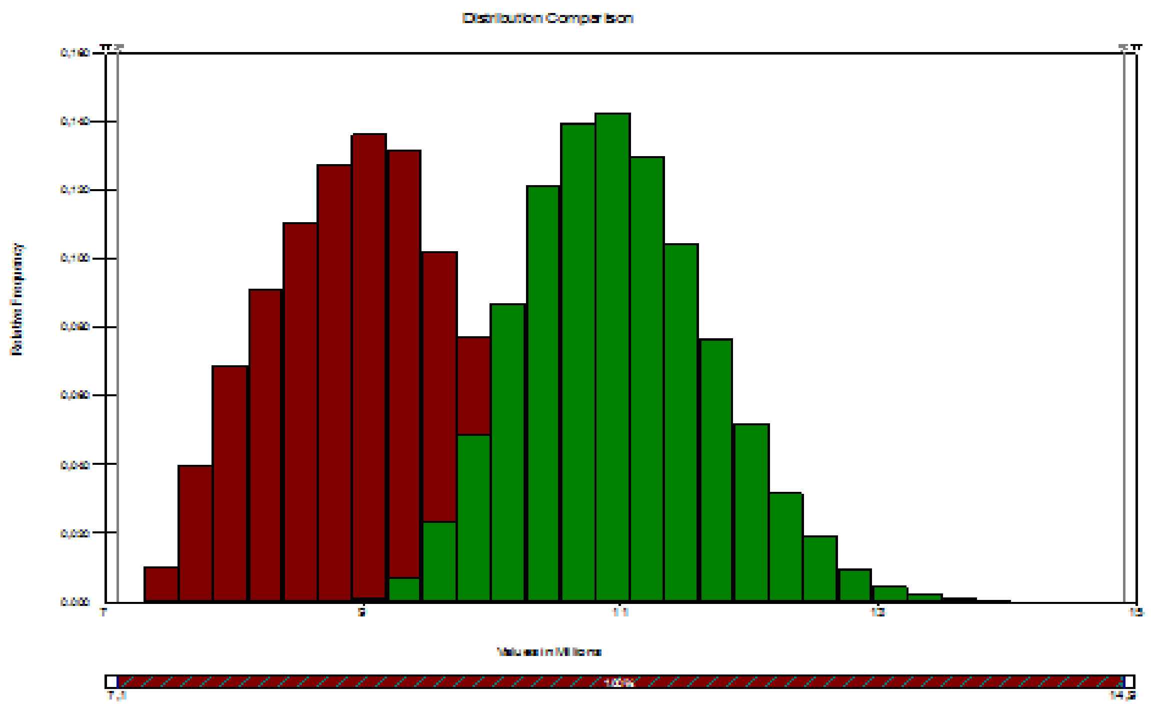


Figure 13: Illustration of Monte Carlo Simulations result comparing Standard vs. Sustainable building (source: D. Lorenz)

- **Monte Carlo Simulations case study 2**

A building owner is confronted with different retrofit/ refurbishment possibilities for a prime location office building in Paris for a semi vacant building. First, the building owner can maintain the building in its existing conditions (BAU scenario). However the marketability prospects are quite low since the location mainly attracts large companies aiming for high quality office buildings to the newest standard. Second, the building owner may choose to perform a building retrofit to improve the overall building quality. However, sustainability improvements do not exceed regulatory requirements (scenario RT). The marketability prospects are better but the building could still fail to attract a single tenant who would rent the whole building. Last scenario consists in a more ambitious upgrade resulting in a sustainability credential (scenario HQE). The aim is to attract a unique tenant that would rent to whole building.

**Table 7** presents key assumptions used as well as the result from the DCF calculation. The sustainability upgrade appears as the best choice. The distribution profile (see **Table 8**) confirms this analysis.

Table 7: Key assumptions and results for a DCF calculation performed to assess a sustainability retrofit
(source: Kamelgarn and Hovorka, 2013)

| | BAU | RT | HQE |
|---|---|---|---|
| **Investment (€)** | 0 | 13 000 000 | 18 300 000 |
| **Annual rental revenue (full occupancy) (€)** | 4 288 611 | 5 685 730 | 6 054 200 |
| **Annual Rental growth rate (%)** | 1.50% | 1.60% | 1.70% |
| **Discount rate (%)** | 7.75% | 6.80% | 6.70% |
| **Vacancy period between leases (months)** | 12 | 10 | 9 |
| **Maintenance and operation costs (including vacancy) (€)** | 124 257 | 91 855 | 76 310 |
| **DCF t=0 calculation (accounting for investment costs) (€)** | 52 748 917 | 82 191 774 | 88 243 576 |
| **Asset value t=1(€)** | 52 748 917 | 89 926 650 | 100 377 224 |

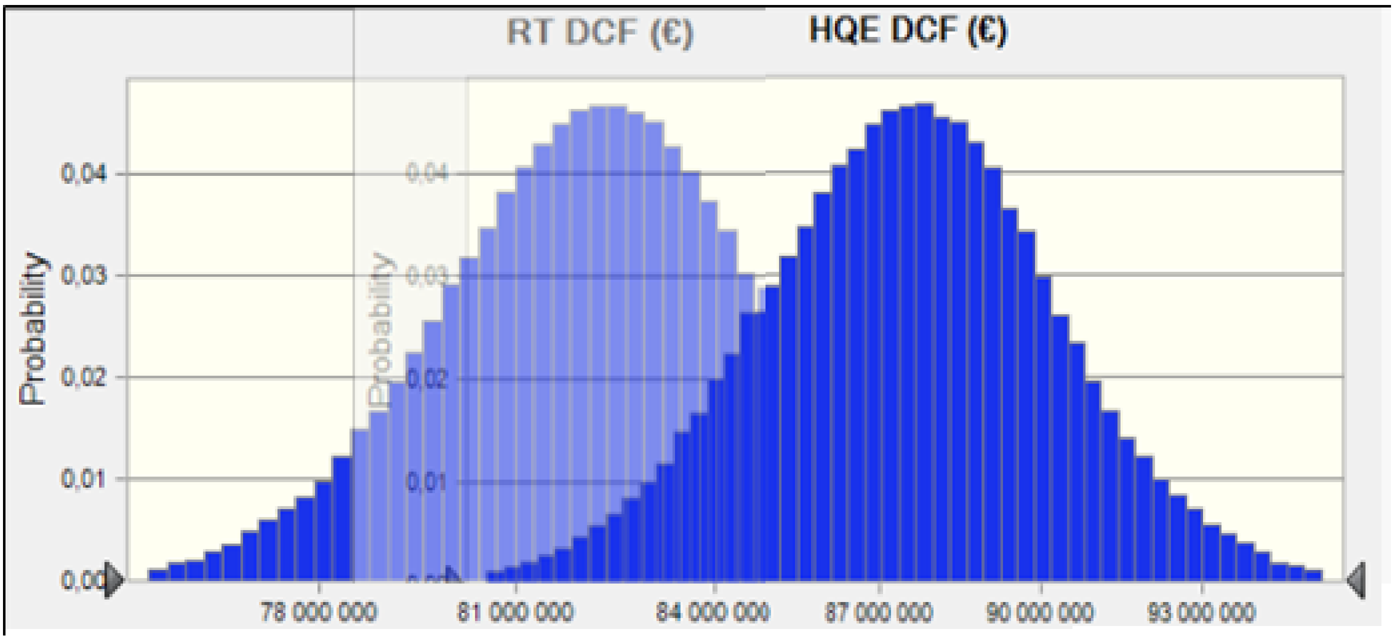


Figure 14: Results of the Monte Carlo Simulations result comparing sustainability retrofits (source: Y. Kamelgarn)

**For more information** see Kamelgarn and Hovorka, 2013.

## 2.4 Accounting for flexibility

This sub-section examines the current state of practices as the regards the integration of buildings physical flexibility into investment decision-making and valuation.

- **Defining and assessing flexibility**

Flexibility is a sustainability-related building characteristic. Its Integration into valuation and investment decision-making is important as flexibility can have a considerable impact on building occupancy rate, retrofit costs and environmental performance through lower consumption of building materials. Moreover, flexibility can reduce the risks associated with buildings.

The importance of flexibility in building design is increasing due to:

- Increasing uncertainty on the organizational activities of occupants – rapid changes in several industries leading to new ways of working,
- Emerging open building based design and technical solutions for flexibility (Sivunen et al., 2014),
- Better understanding on how to measure it technically (Kendall et al., 2012) (De Neufville,2006;Vimpari et al., 2014; Kajander et al., 2014),
- Stronger market and regulatory emphasis given to materials efficiency (e.g., EU Commission's aim for Resource Efficient Europe),
- Increasing awareness of valuers as regards the impact of adaptability and building flexibility on market value (Sayce et al., 2013).

Two different types of physical flexibility of buildings should be distinguished: service flexibility and building adaptability. **Service flexibility** refers to the capacity of the facilities to be operated and used in different ways within the same use without retrofit. **Building adaptability** refers to the capacity of the building to be used by third parties and adapted to changes typically occurring many years ahead, such as changes of users (Saari et al., 2007).

Flexibility has been a buzzword in the real estate and construction industry since 1980s. Taking flexibility systematically into practice has not yet been achieved in most countries. One major reason for this is that there is still no common explicit technical requirements, metrics for assessment and benchmarks of success (or failure) for flexibility and adaptability (Kendall et al., 2013). In addition, although building owners, valuers and analysts increasingly acknowledge the impact of service flexibility and adaptability on market value, there is no standardised framework to integrate the information collected into investment decisions and valuation exercises. Moreover, valuing flexibility in buildings is not straightforward due to uncertainty as regards potential future cash flows. Pricing flexibility is particularly difficult because its value depends on the uncertainty as regards future organizational activities hosted by the building, i.e. whether the flexibility will be actually put into use (e.g., Vimpari et al., 2014).

- **Initiatives to better account for flexibility**

New approaches for measuring and valuing service flexibility and adaptability have emerged. Recently researchers directly addressing flexible physical facilities have proposed a set of criteria for determining the level of adaptability of buildings. In fact, adaptability can be technically rated at building and portfolio level by examining building characteristics such as horizontal and vertical building expansion capacity, minimal internal structural walls, floor-to-floor height, building geometry, floor structural loading capacity, shell space, shaft space reservation and systems separation (see Kendall et al. (2013) for a detailed description).

In the field of valuing service flexibility and adaptability, real option analysis (ROA) is a promising approach to compute the financial value of flexibility and improve building design through flexibility targets. An increasing number of scientific case studies, especially public building projects, apply ROA to the valuation of physical flexibility and adaptability of buildings (See Table 8). ROA aims to solve the difficulties associated with the valuation of flexibility and enhance lifecycle performance of buildings by providing a systematic investment decision-making process for flexibility. Since the value of flexibility is a contingent claim into the future, option-pricing theory should supplement the DCF valuation, which cannot properly handle asymmetric value and decision-making (Trigeorgis and Mason, 1987; French and Gabrielli, 2005). Flexibility has asymmetric value since it correspond to an option limiting the downside risk while protecting the upside potential. In addition to valuing flexibility, ROA can help building owners to set design targets for building projects i.e., profit, cost, quality, location and time of flexibility.

ROA is an approach that is often considered to supplement the popular DCF analysis when evaluating investments in real assets. In ROA embedded options, real asset investments are valued using option pricing techniques originating from the financial world. The most widely known techniques to solve the option value are the Black-Scholes equation, binomial option pricing model and the Monte-Carlo method (Amram and Kulatika, 1999). In all of these methods, the option value is calculated by determining the range of values of the underlying asset. The key component in determining the range is finding out the volatility of the asset. This has been relatively straightforward in the original financial applications where detailed historical data have been available. However, this is often very challenging with real assets and ROA has received criticism (e.g. Lander, 1998, Oppenheimer, 2002) for this exact reason, even though the practical applicability of the approach has been well acknowledged.

Recently, the calculus for valuing real assets with ROA has become more straightforward. For example, in the fuzzy payoff method (FPOM) only three payoff scenarios (minimum, best guess, maximum) are needed. Option value thus corresponds to the possibilistic mean of the positive side of the value terrain weighted by the positive area of the pay-off distribution over the whole area of the pay-off distribution. Using this method, option value can be calculated with a simple spreadsheet. **Figure 15** illustrates a ROA model utilizing the payoff method.

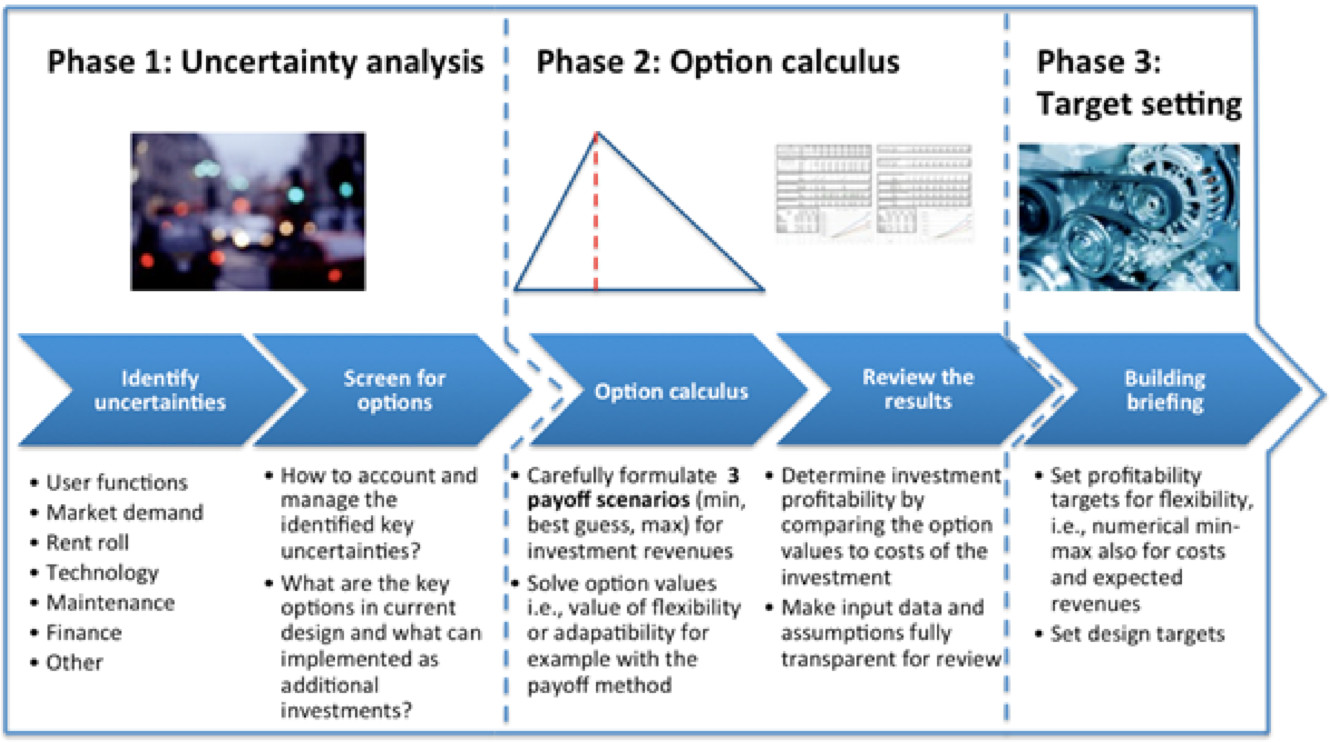


Figure 15: Illustration of Real Options Analysis (ROA) method using the payoff method
(source: J-K. Kajander and M. Sivunen)

In fuzzy payoff method (FPOM), setting probabilities is replaced by fuzzy set theory. FPOM was originally developed on the basis of the Datar-Mathews method (Datar and Matthews, 2004), which calculates the real options value from the pay-off distribution of net present values (NPV) generated by Monte-Carlo simulations. Collan et al. (2009) suggested replacing the probabilistic theory used in the Datar-Mathews method (and in other mainstream ROA methods) with fuzzy set theory (Zadeh, 1965). In the fuzzy set theory, different propositions have a degree of membership in a set, i.e. membership is 0 (complete non-membership), 1 (complete membership) or a value between 0 and 1 (an intermediate degree of membership). This suggestion allowed a simplification, with the projection of uncertainty into three NPV scenarios: minimum, best guess (i.e., the most likely scenario, which is normally drawn up in investment analysis) and maximum. These three scenarios are treated as triangular fuzzy numbers that form a triangular pay-off distribution where the best guess scenario has complete membership, the minimum and maximum scenarios have complete non-membership, and other scenarios in-between have intermediate degrees of membership. This asymmetrical information is used as the basis to form a triangular pay-off distribution, that is “a graphical presentation of the range of possible future pay-offs the investment can take” (Collan et al., 2009). For more information on the FPOM and application in construction projects, please see e.g., Collan et al., (2009), Collan (2012), Vimpari et al., (2014a), Kajander et al., (2014).

**Table 8: Review of recent ROA scientific case studies and project application examples** (adapted from Vimpari, 2014, Kajander *et. al.*, 2014, Vimpari et *al.*, 2014).

| Project name / article reference | Period | Country | Type of value | Key content |
|---|---|---|---|---|
| De Neufville (2002), (2003) | 2002-2003 | USA | Investment worth | De Neufville used ROA for valuing flexibility in engineering systems. Three major elements in valuing flexibility were identified: estimating the risk of an investment with/without options, calculation of the value of the options and identifying the strategies for exploiting the options. De Neufville also concluded that ROA is "a blend of technical and market considerations", where the value of an option is often derived from expert approximations rather than historical analysis. |
| Greden *et al.* (2005) | 2005 | USA | Market value | The research group studied the market value of an innovative naturally ventilated building with an embedded option to install mechanical cooling in the future. |
| Greden and Glicksman (2005) | 2005 | USA | Investment worth | Greden and Glicksman (2005) conducted a study for valuing flexible space with real options. A real options model for addressing the problem of calculating how much flexible space is justified economically was developed. The model is based on simulation and decision-tree analysis where probabilities are assigned to different amounts of flexible space requirements. They concluded that real options could support decision-making in flexibility investments. |
| De Neufville *et al.* (2006) | 2006 | USA | Investment worth | De Neufville et al. (2006) demonstrated the merits of ROA in valuing flexibility with a parking garage case. In the case, it was calculated that flexibility (i.e. the up-front costs of the footings and columns) allowing the garage to be built in stages (i.e. additional levels could be built on top of the initial structure at a later date) rather than all at once reduces the risk and increases the expected value of the investment. One of the key points is that flexibility limits downside losses while retaining the advantage of upside potential values. |
| Guma et *al.*, (2009) | 2009 | USA | Investment worth | Guma et al. (2009) studied vertical phasing as a corporate real estate strategy. Several case studies identified that option to raise a building can highly improve real estate investment project's lifecycle performance. |
| Fawcett (2011) and Fawcett et *al.,* (2012) | 2011-2012 | UK | - | Fawcett (2011) and Fawcett et al. (2012) discussed the importance of real options in designing buildings; it was proposed that options-based decision-making is a continuum for LCC and LCA calculation methods. |
| Dortland et al., (2012, 2014) | 2012-2014 | The Netherlands | - | Dortland et al. (2012) studied different building flexibility in healthcare building investments. ROA were found as effective tools to increase the management of understanding the importance of flexibility |

| | | | | |
|---|---|---|---|---|
| Cardin *et al.,* (2013a, 2013b) | 2012-2013 | USA, Singa-pore | - | Cardin et al. (2013a) developed a framework for optimizing the phasing of a development project. The method is used for recognizing flexibility that enhances value of a real estate project. Furthermore, Cardin et al. (2013b) evaluated methods for identifying flexibility to engineering systems design. Prompting mechanisms and explicit training was found to increase the flexibility in a case study of real estate development. |
| Vimpari *et al.,* (2014a) | 2013-2014 | Finland | Investment worth, total economic value | Vimpari et al. (2014) valuate flexibility in a real life retrofit investment case with ROA and evaluate the empirical usability of ROA results compared with traditional DCF valuation results. The main finding of this paper is that real options analysis; especially the fuzzy pay-off method can be used for assessing the monetary value of flexibility. The applicability of the fuzzy pay-off method into a practical investment case was found straightforward because assignment of probabilities into different uncertainty scenarios was unnecessary. |
| Vimpari *et al.,* (2014b) | 2013-2014 | Finland | Investment worth | Vimpari et al. (2014) used ROA to evaluate risk management actions in a large Finnish healthcare facility PPP project. ROA is used for identifying uncertainties and valuating flexibilities from the provider's perspective. For example, the monetary value of service flexibility and on-site energy production is documented. |
| Kajander *et al.,* (2014) | 2013-2014 | Finland | Investment worth, total economic value | This paper is one of the first known studies to explore real option analysis (ROA) as a potential approach to evaluate the life-cycle profitability of investments in IAQ (indoor air quality). The research is carried out as a case study, which is a healthcare construction project in Finland. The main finding of this paper is that ROA seems to provide a viable method for the evaluation of investments in IAQ. In the case study, the economic benefits of IAQ to the tenant are noticeable. The real option value of the economic benefits of better IAQ is almost 4 million euros and the real option pay-off of the IAQ investment exceeds 0.5 million euros. The results are indicative only but imply that ROA is a promising method to evaluate investments in IAQ. |

**ROA case study example 1: Valuing service flexibility in a retrofit project**

**Investor:** Senate Properties, the largest property owner in Finland. Largest owner of Senate is the Finnish Government.

**Need:** Senate wants to minimize vacancy in its office premises. In the case building, Senate Properties is about to make a retrofit investment to increase space efficiency in a governmental office building in order to fill in more governmental occupants. Senate wants to find out whether it should invest in service flexibility at the same time. The case building is a governmental office building of 12 000 sqm located in the city of Lappeenranta, Finland. It was built in the 1970s and it has 10 occupants.

**Solution in case project**: ROA was used for valuing service flexibility investment in the building and how much Senate should invest in service flexibility. Moreover, the economic benefits for occupants were evaluated with ROA. Service flexibility was valued by first estimating the need for flexible space in three scenarios based on tenant risk analysis. Based on the flexible space needed, lost income to Senate and cost of unused space to occupants were calculated in three cumulative payoff scenarios (minimum, best guess, maximum). Following that, the option value of service flexibility was thus calculated based on the three cumulative payoff scenarios. Example of ROA output is illustrated in **Table 9.**

**Table 9: Example of ROA output in the case building (source:** Vimpari *et al*., 2014a)

| Investment variable | Euros |
|---|---|
| Service flexibility payoff scenarios for 10 years in the case building | Minimum 184 000<br>Best guess 279 000<br>Maximum 462 000 |
| Service flexibility option value<br>a) for Senate,<br>b) Senate and tenants | a) 294 000,<br>b) 706 000 |
| Service flexibility investment cost (office refurbishment and small changes to HVAC system) | 65 per sqm<br>(440 000 for the whole building) |

**For more information** see Vimpari *et al*., 2014a.

- **ROA case study example 2: ROA as an add-on to DCF in a new healthcare project**

**Investor:** City of Järvenpää, Finland

**Need:** The city wants to build a new healthcare centre for its social and healthcare operations. Project duration is 2014-2016, capacity 13 500 sqm, and total budget exceeds € 50M. The objectives of the project are :

- The design process and solution must enable the city to generate health benefits to the inhabitants via new healthcare processes and methods
- The design solution must support the healthcare functions and adapt to functional changes.
- The design solution must be in the budget
- The facilities must be put in use at October 2016

**Solution in case project:** ROA was used as an add-on to DCF in project investment and risk analysis. For example, the option value of service flexibility and adaptability was added to the DCF valuation. Moreover, ROA was used in functional space / room programming to set the design, cost and profit targets for healthcare center service flexibility and adaptability.

**For more information** see e.g., Vimpari et al., 2014b and Sivunen et al. 2014.

## 2.5 Accounting for risks and building resilience to future changes

As sustainability-related features become market standard, they represent additional risks for buildings with poor sustainability performance (IIGCC, 2014).

- **Flexibility and risks associated with sustainability**

Market expectations on sustainability performance evolve over time. To continue meeting with the same level of tenants' satisfaction, buildings are required to meet with new functionalities and more stringent performance target. Consequently, as illustrated in Figure 16, over their life cycle, buildings will undergo several retrofit and/or refurbishment with more and more ambitious level of sustainability performance.

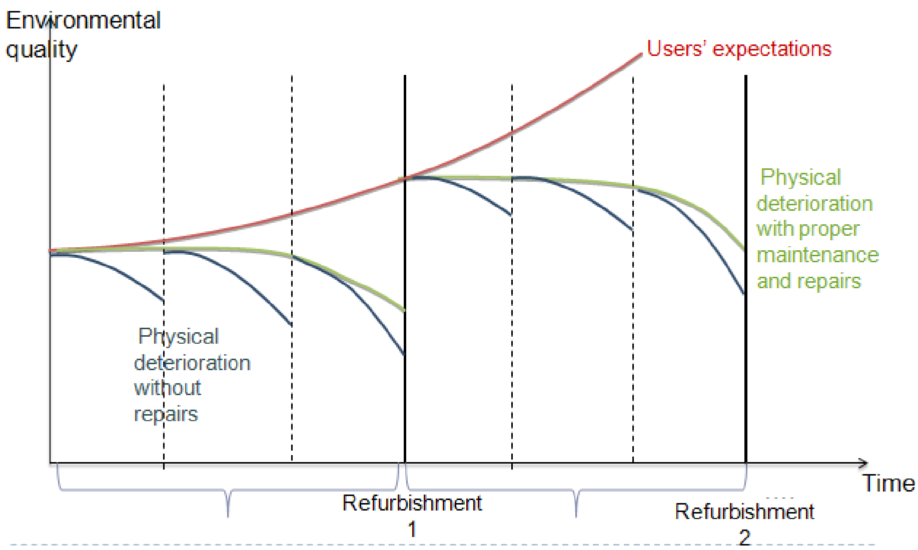


Figure 16: Illustration of obsolescence associate with sustainability (source: Y. Kamelgarn)

Along these lines, sustainability may be considered as a source of obsolescence. In traditional real estate literature, obsolescence is described as "a decline in utility not directly related to physical usage or the passage of time" (Baum, 1993). Flexible building design and adaptability are features that can improve the resiliency of building to these future changes.

- **Existing initiatives to better account for risks associated with sustainability**

The risks of obsolescence associated with the rise of sustainability topics have been investigated in several different ways by various research projects. The main approach proposed consists in using a risk rating system. The general approach used for risk assessment in real estate is discussed by Adair and Hutchison (2005).

In its guidance note Sustainability and Commercial Property Valuation (2013), the RICS recommends that investors and valuers explicitly account for these risks directly in the cash flows or in the discount rate if an explicit integration is not possible. More globally, the IIGCC (2014) recommends investors tackle the risks associated with sustainability and climate change trends suggesting key questions they should ask their asset managers and consultants to better manage these risks.

Several practical tools to assess these risks are emerging using building ratings. Incorporations of sustainability-related features in risk assessments is for example the key approach developed by the Sustainable Appraisal Project or the investors' tool IPD Eco Pas.

## SECTION 3: RECOMMENDATIONS FOR VALUERS AND INVESTMENT ADVISORS/ANALYSTS

This section develops recommendations for the integration of sustainability-related information into decision-making process and valuations. It is mainly based on the previous review of literature and current practices and was discussed with experts during the workshop.

### 3.1 Developing a holistic approach of building performance

A separate consideration of overall building quality (in the sense of value-influencing building characteristics) and sustainability-related attributes does no longer make sense. Instead, sustainability-related attributes like environmental and health-friendliness, energy and resource efficiency, etc. can be treated as constituents of an **"extended" overall building quality**. Appendix 7 presents the list of key performance characteristics that should be documented according to the UNEP FI (2014).

To integrate sustainability into investment decision and value appraisals, the starting point dwells in **a systemic description of the building**. Sustainability-related features are part of the description of a building as a whole system. Traditional characteristics to describe building still apply, but need to be adapted into a new longer list of information. Understanding the context, the comfort level and the building use is also paramount to put into perspective the data collected. This can help assess the building quality and compare its performance with a benchmark.

**Data collection should be integrated in the building management processes**. Data is still mainly collected on a punctual basis (for transactions, or on a yearly basis by external parties) with no systematic approach that could allow investors to integrate data collection into their building management process. The cost of systematic data collection would probably be lower than the costs of punctual due diligences required to start each time from scratch.

**Information should be collected directly from the people who have access to the data**, namely designers and contractors for new buildings, and facility managers for existing buildings. Technical information should be collected during the building life cycle to be used as need arises. For example, technical documentation is mandatory in France when the building is delivered. However, it is usually not been stored properly and is usually not used.

The development of building information modelling (BIM) and building "pass" should help the data collection required along the building life cycle. Building pass (or building passport or file) should be a "life –cycle associated document" enabling investors to follow information along the whole building life.

In addition, the verification of this information by third parties would increase the value of the data.

## 3.2 Distinguishing between labels brand value and the value of sustainability-related features

The mere presence or absence of a certification credential (BREEAM, LEED, HQE, BNB/DGNB or equivalent) is not sufficient to analyse the impact of sustainability performance on value. Certifications cannot be considered as absolute measures of sustainability performance. The lack of certification does not mean that the building is not sustainable. Conversely, the presence of a certification may correspond to different levels of performance.

**A deeper analysis of the individual sustainability-related features is required**. As a minimum, robust decisions should require an analysis of the sustainability credential achieved for the various sustainability topics constituting the certification framework. In the best scenario, knowledge on the effective performance in-use would be preferred since ultimately it is the effective performance which will result in benefits for the investors and their stakeholders.

Separately, the presence of a certification scheme may commend **an additional value premium associated with the brand value of the certification schemes** independently of the sustainability performance itself. This brand value would be strengthened by an increase in the reliability of the certifications to measure and guarantee sustainability performance in-use. This brand value will vary according to the building context and location, and will depend on the tenants' CSR policies.

## 3.3 Broadening the understanding of value

Two types of value assessment should be distinguished:

- the systemic analysis of the multiple benefits of sustainability-related features,
- the financial appraisal of the contribution of sustainability credentials to investment worth and market value.

**First, the analysis of the various benefits of sustainable real estate can enable investors to identify drivers for value creation for all stakeholders**. Value is here understood as the monetary and non-monetary gains that can be expected from sustainability–related features. This value can be economic (for example a reduction in the life cycle costs), social and cultural (cultural heritage, urban revival, improved comfort, etc.), intangible and resulting from a better brand image or environmental (protection of environmental resources, climate change mitigation, etc.).

**Second, the appraisal of the impacts of sustainability performance on the various market value drivers (rents, rental growth, operation and capital expenses, letting durations, yields and risk premium) can enable valuers and investors to better integrate sustainability into the calculation of market value and investment worth**. Value corresponds here to a financial concept, which calculation is framed by professional valuation bodies and reflects anticipation on cash flows.

Identifying the various benefits of sustainability for the different stakeholders may inform the financial decisions. In a shifting context, understanding the mechanisms at stake is paramount to determine how sustainability-related features can create value and take informed decisions. However, at a given date for a given type of market, all the benefits identified will probably not be reflected in the financial value. On the whole, there is no straightforward formula to translate sustainability performance into financial value. The exercise varies according to the building, the market context, the type of stakeholders, etc.

Widening the understanding of value beyond directly financial considerations may enables valuers and investors to assess the building as a whole, identify the value creation channels for all stakeholders, choose more accurately the performance targets and associated sustainability features, promote the building to stakeholders to ensure their adhesion to the project, and ultimately increase the future-proofness of the building.

## 3.4 Accounting for sustainability-related information more transparently into valuation through a Discounted Cash Flows (DCF) approach

**The Discounted Cash Flow (DCF) framework appears as the most appropriate method to integrate sustainability-related information into valuation methodologies.** This framework enables investors and valuers to account transparently for sustainability in the input parameters (rent, rental growth, operation expenses, capital expenses, etc.). In addition, the DCF methodology particularly lends itself to include data from other methodologies; e.g. life cycle costing (as an LCC in a widened sense including incoming payments) or full financial plans.

There is no standard format for DCF calculations. Different formats are used according to the different types of buildings, the types of activities, as well as the different regions. However, in order to reach a generic basic system, **it is possible to find agreement on the listing of possible DCF input parameters and the types of quality characteristics that should be reflected in each input parameter.** This listing should embrace all possible input parameters to form a basis for a standardised DCF framework. According to each valuation context, single input parameters from the full listing could then be enabled or disabled.

This report proposes generic recommendations on the DCF format for the integration of sustainability related-information in a transparent manner. This generic framework has been discussed during the research project workshop and reflects a common agreement between the specialists who participated.

**Recommendations on the DCF framework itself:**

- If possible, relevant (i.e. value-influencing) sustainability characteristics of a building should be translated into impacts on cash flow, rather than in the discount rates.

- Characteristics and attributes which cannot directly be taken into account within the modelling of the cash flow should be factored into the determination of the discount and capitalisation rates. However, to improve transparency, these data should also be correctly documented in the valuation report.

- Maintenance costs need to be appraised separately from replacement costs and retrofit costs.

- Simultaneous consideration of quality characteristics within several DCF input parameters (e.g. rent, discount and/or cap rate) is valid and appropriate in order to account for "multi-effects". However, it should only be done if justified in order to avoid "double-counting".

- DCF input parameters and assumptions used to adjust for sustainability performance should be presented explicitly.

**Recommendations on the presentations of the assumptions:**

This report thus suggests the use of the generic assumptions format presented in Table 10 to ensure that sustainability-related features are integrated consistently among valuers. For each parameter, integration of sustainability-related information should be documented when relevant (input factors in bold in the table).

**Table 10: Proposal of generic format for a generic DCF framework presentation to ensure accounting of sustainability related-information**

| Rental space information | Building management information | Market assumptions | Terminal value assumptions |
|---|---|---|---|
| For each lease:<br>- Type of lease<br>- Rental level<br>- Area<br>- **Utilities payments (energy, water and waste bills)**<br>- **% of utilities** payment charged back to tenants | - **Operation expenses and repairs**<br>- **Capital expenses (modernisation and replacement)** | - **Market rent**<br>- Inflation<br>- **Discount rate**<br>- **Capitalisation rate**<br>- **Duration to let**<br>- Letting fee | - **Market rent at exit date**<br>- **Maintenance costs at exit date**<br>- **Capitalisation rate at exit date**<br>- **Utilities payments at exit date**<br>- % of utilities payment charged back to tenants at exit date |

**Recommendations on where key sustainability related information should be integrated**

For each input parameter, **Table 11** presents some recommendations for taking account of building characteristics. For consistency purposes, the list of characteristics used is the one proposed by UNEP FI (2014) (see **Appendix 7**).

Table 11 : Proposal for the allocation of sustainability-related quality and performance characteristics into DCF input parameters)

| DCF Input Parameters | Key sustainability-related quality and performance characteristics |
|---|---|
| **Market rent** | - Comfort level,<br>- Building related services: serviceability<br>- Aesthetic and cultural quality<br>- Presence of certification schemes and labels (and associated brand image)<br>- Energy performance level (based on EPC or other assessments)<br>- Mandatory requirements and market standards as regards sustainability performance<br>- Space efficiency<br>- Accessibility |
| **Current utilities** | - Level of utilities costs attributable to the tenants and the owner<br>- Source of energy (presence of renewable sources)<br>- Energy costs trends |
| **Operation expenses and repairs** | - Durability and maintainability of components<br>- Ease of cleaning (part of maintenance)<br>- Cost of repairs<br>- Reliability of technical installation (failure per hours of running time) |
| **Capital expenses** | - Modernisation expenses (energy efficiency retrofit, improvement of functionality, resources consumption, etc.)<br>- Costs for adaptation to climate change and user needs<br>- Dismantling, landfill and /or recycling of components |
| **Duration to let** | - Aesthetic and cultural quality<br>- Flexibility and adaptability (easy to move in),<br>- Compliance with ESG regulation of tenants<br>- Presence of certification schemes and labels (and associated brand image)<br>- Space efficiency<br>- Accessibility |
| **Discount rate** | - Discount rate Risk assessment of impact of climate change<br>- Resilience against natural and climate hazard (eg flooding, etc.)<br>- Structural safety |
| **Capitalisation rate** | - Durability and recyclability of the building<br>- Future-proofness and degree of resistance against various forms of obsolescence<br>- Compliance with foreseen regulations<br>- Long-term aesthetic quality |

## 3.5 Accounting for uncertainty through Monte-Carlo simulations

All the input parameters of a Discounted Cash Flow calculation are uncertain to a lessor or greater extent, depending on the quality of the underlying information and the reliability of the information source.

At first, it is important to identify uncertainties associated to the valuation results. Listing technical, legal and market uncertainties is paramount to understand the level of precision associated with an output. In cases of risks of changes in the context, this assessment may also help understand the future-proofness of a building, i.e. the capacity to protect its value for different future scenarii.

Second, the impact of these uncertainties on the valuation result must be examined. The method of choice to account for these uncertainties is Monte-Carlo-Simulations. They can be used to visualize how the uncertainties on different key parameters affect the risk profile of the valuation results. Figure 17 presents the general approach to account for uncertainties in a DCF calculation.

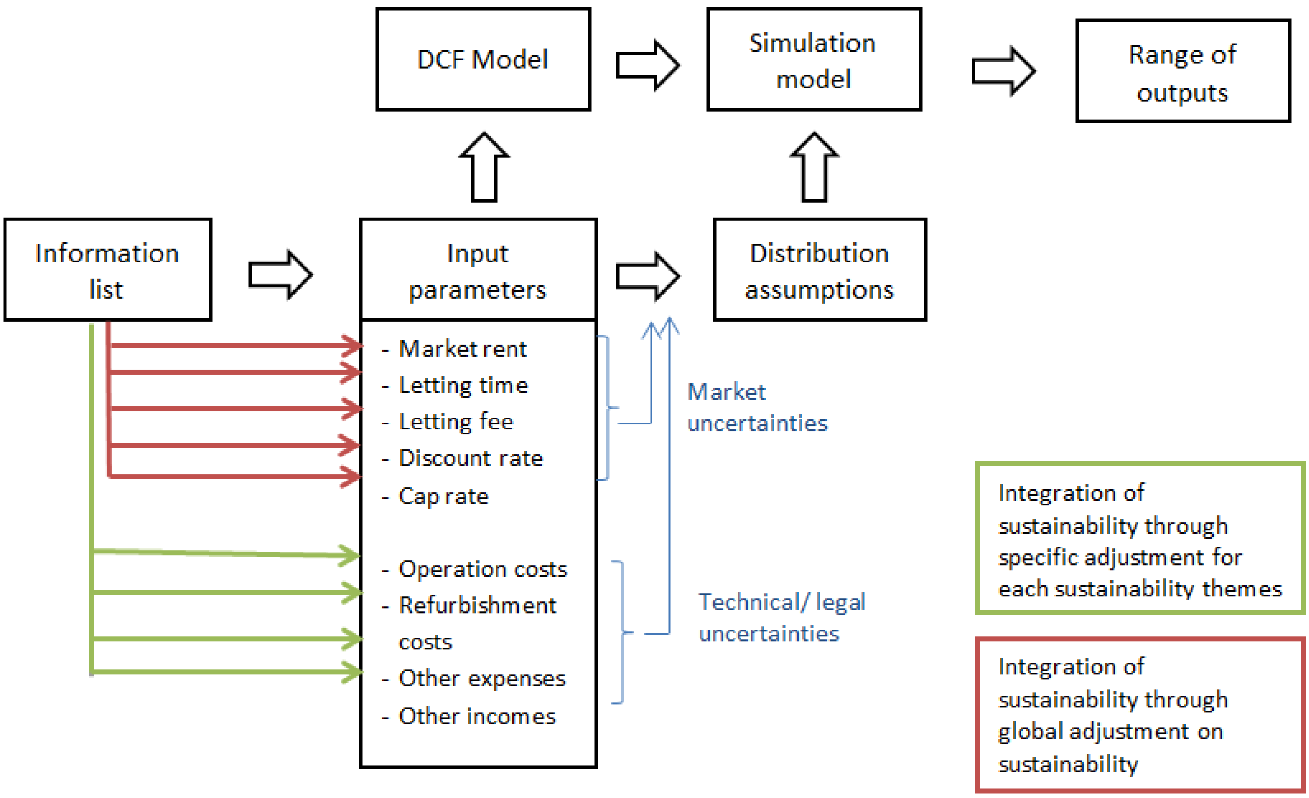


**Figure 17: General approach to account for uncertainties associated to sustainability in DCF calculation**
(Adapted to sustainability issues from French and Gabrielli (2005))

Monte-Carlo simulations can thus be used both to asses risk profile and perform sensitivity analysis. Risk departments of large investment firms already use similar methods to appraise the potential losses associated with depreciation for example. Exploiting synergies between departments could enables investors to also use Monte-Carlo simulations to account for uncertainties associated with sustainability features and assess risks and potential gains associated with sustainability performance.

## 3.6 Accounting for flexibility and adaptability

Flexibility should be systematically addressed and integrated into financial value appraisals and investment decisions. The value of flexibility and building adaptability depends particularly on the uncertainty as regards the future organizational activities hosted by the building, i.e. whether the flexibility will be actually put into use. Since the value of flexibility is a contingent claim into the future, real option analysis (ROA) should supplement the DCF valuation, which cannot typically properly handle asymmetric value / decision-making.

Based on the expert interviews and a review of state-of-the art projects, experiences and studies, this report recommends that valuers and building owners apply ROA to value service flexibility and adaptability. ROA is a systematic method to improve building investment worth appraisals and decision-making, particularly for service flexibility and adaptability. In the short-term, ROA should be applied particularly to publicly owned buildings with uncertain future user groups and needs and long life-cycle.

ROA can be used as an add-on to supplement DCF valuation and as a stand-alone solution. The calculus suggested in this report is practical and straightforward, as only three payoff scenarios are needed for valuation for example with the payoff method. In the long term, other owner-occupier segments in the private sector can also benefit from ROA as real estate markets develop to better account for physical flexibility based on standardization of flexibility and evidence from earlier projects.

# SECTION 4: RECOMMENDATIONS FOR CERTIFICATION BODIES

This section develops recommendations for the integration of sustainability-related information relevant to value assessment into certification schemes. It is mainly based on the previous review of literature and current practices and was discussed during the workshop.

## 4.1 Providing more information on effective in-use sustainability performance

Certification schemes should better distinguish intrinsic and effective performance. This later information is particularly relevant for the identification of value creation mechanisms. Links with energy performance contracting (guaranteed performance) could help. This would help make more visible the performance targets resulting in concrete benefits for investors and their various stakeholders.

Ideally, certification schemes could thus translate into two impacts on value: value associated with the effective performance, and an additional brand value associated with the reliability of this performance assessment by a third party. This would help achieve a virtuous circle where a certification corresponding to a given level of sustainability performance commends an added value, and where the reliability associated with the certification scheme is associated with an additional brand value corresponding to a trust in the performance assessment.

## 4.2 Better highlighting the sustainability features which have the stronger impact on value

The new generation of certification schemes should help create a clearer links between asset value and the presence of a certification. In addition to environmental features, the analysis of flexibility, building functionality, building indoor comfort, economic (i.e. LCC) and social performance should improve the match between investors' need as regards sustainability-related information relevant to value creation and market value assessment. **Table 12** presents categories of features of interests to valuers and investors:

Table 12: Key features identified as of interests for investors and valuers

| |
|---|
| **- Occupation quality** |
| Location and site integration |
| Image, cultural quality |
| Comfort level |
| Building related services |
| Serviceability |
| **- Economic quality** |
| Global cost per working station |
| Life cycle costs |
| Utilities costs (energy, water, waste) |
| **- Technical quality** |
| Maintenance costs including replacement costs and running costs |
| State of the equipment |
| Reliability of the equipment |
| Modernisation costs |
| **- Flexibility and adaptability** |
| Space efficiency (windows width, absence of columns, ceilings heights) |
| Churn rate |
| Churn cost |
| **- Environmental quality** |
| Energy and water consumption |
| Waste management |

## 4.3 Providing sustainability-related information in a format more easily usable by investors, valuers and analysts

Certification schemes should standardise the documentation and presentation of performance assessment results. The evolution of certification frameworks, though completely understandable since they result from the role of labels to continuously push forward market players, may lead to confusion if the same brand label refers to different performance levels. In addition, the evolution of certification schemes may lead to an obsolescence of previous labels. For example, a gold certification obtained in 2010 may nowadays only be equivalent with a silver certification obtained today due to the certification schemes evolution and more stringent requirements. This confusion may be detrimental to the brand image of the certification scheme in the long run. Clients may fail to take account of the certification year and be disappointed if the building does not achieve the performance expected.

The information included in the label should be presented in a disaggregated manner (in addition to the overall performance) so as for individual data to be usable by investors and valuers. The sole disclosure of the final assessment results is not sufficient. Individual information on each sustainability topics and disclosure of raw output data (metrics) that could be used by investors, analysts and valuers in their data collection should also be provided.

In addition to the presentation of disaggregated assessment results, certification schemes should document the technical data and assumptions on which the outputs are based. For example, for energy consumption assessment at the conception stage, the assumption on occupancy and comfort should be provided. This would allow a “reassessment” in the case of benchmarks that are subject to later changes.

Links between certification framework and building “Identity cards” (and BIM more generally) could help create a virtuous loop in the structuration of the flow of information.

## Outlook and future prospects

The integration of sustainability-related information into investment decision making process and valuation should help foster the sustainability agenda and enable investors to better manage the risks associated with the rise of the sustainability issues.

This report has proposed recommendations to improve transparency and consistency of this integration. In particular, it has proposed a generic discounted cash flow format to account for key sustainability characteristics. Further work is still required to adapt this generic format to the specificities of each country and profession using DCF calculations.

In addition, the systematization and robustness of data collection to assess sustainability performance should be a paramount feature to help along this integration. Further work on Building Information Modelling and Building Passport should be required to connect the data collection and management phase to the investment and decision-making process phase.

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## Appendix 1: Examples of possible translation mechanisms of sustainability features into potential monetary impacts

| | Themes | Potential aspects to consider | Likely impact on financial value drivers |
|---|---|---|---|
| **vulnerability to risks** | **Vulnerability to global warming** | improvement of the long term comfort by taking into account the ‘heat island’ effect | longer lifetime, depreciation |
| | Example of indicators: sensibility of construction choices to global warming | lower insurance for buildings conceived to face those risks | comparison with existing insurance premiums and calculation of likely savings |
| | **Vulnerability to weather and flooding risks** | exposure to a future disaster, anticipation on future regulatory compliance towards the reliability of the structure | longer lifetime, depreciation |
| | Example of indicators: sensibility of construction choices | lower insurance for buildings conceived to face those risks | comparison with existing insurance premiums and calculation of likely savings |
| **materials / construction site** | **Embodied energy and associated carbon footprint** | access to new and more attractive funding | reduced initial investment (taking tax scheme into account in the calculation of costs) |
| | Example of indicators: t eq$CO_2$, primary energy consumption | anticipation of a future compulsory price of $CO_2$ (carbon market, taxes) hence potential impact on earnings and outlays. | growth of revenues, price of the avoided $CO_2$ |
| | **Natural resources consumption** | at the end of lifecycle, the renewable /valuable material can be collected and reuse, generating additional revenues (or less taxes on demolition waste) | outlays at end of lifecycle reduced, earnings at demolition increased |
| | Example of indicators: consumption of non-renewable raw materials, percentage of renewable material used | | |
| | **Environmental impact of construction materials** | reduction of the litigation risk linked to the use of hazardous materials (health, environment) | probability that a litigation might occur and associated costs |
| | Example of indicators: | reduction of the obsolescence risk toward the implementation of more binding regulations | longer lifetime, depreciation |
| | **lifespan of materials / maintenance (quality)** | increased sustainability over time, increased lifespan | longer lifetime, depreciation |
| | Example of indicators: lifespan of materials | eventually reduced maintenance costs | decrease of the maintenance costs |
| | **nuisances linked to construction site** | reduced litigation risks | probability that a litigation might occur and associated costs |
| | Example of indicators: perception of the construction site by residents | improved acceptability of the construction site contractor image | willingness to pay of the contractor |

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|---|---|---|---|
| Energy | **consumption of primary energy** | mitigate risk of being exposed to an increase in the energy price<br>discriminate situation depending on the status of the owner | likely impact on growth of the revenues |
| | Example of indicators: total consumption of primary energy by source, positioning relative to the thermal regulation | decrease in expenses (reverberation of this decrease in expenses for the non-occupant owner: possibility to offer leases "all expenses included") | possible impact on rent and selling price calculation of potential savings that can be reflected the rent |
| | | reduction of the obsolescence risk toward the implementation of more binding regulations concerning the energy expenditure in buildings | depreciation, discount when the building is resold, longer amortization time of the rehabilitation investments |
| | | anticipation of a future compulsory price of $CO_2$ (carbon market, taxes) hence potential impact on earnings and outlays. | growth of revenues<br>risk based approach through the price of avoided $CO_2$ |
| | | changes in tax rules leading to take energy criteria into account in the calculation of the property tax and the housing tax | impact on outlays |
| | | projected rate of unpaid rents and of unoccupied buildings | risk based approach |
| | **energy efficiency of HVAC material** | decrease in the operating and maintenance costs (reassess the sizing of HVAC equipment) | impact on outlays |
| | Example of indicators: equipment types, unavoidable heat recovery | access to new and more attractive funding | reduced initial investment (taking tax scheme into account in the calculation of costs) |
| | | reduction of the obsolescence risk toward the implementation of more binding regulations concerning the energy expenditure in buildings | longer lifetime, depreciation |
| | **specific electricity consumption** | diminution of the operating and maintenance costs (longest lifetime) | impact on outlays |
| | Example of indicators: % of efficient lighting equipment, electricity consumption | decrease in expenses or in the rent (if lease "all expenses included") | possible impact on rent and selling price calculation of potential savings that can be reflected the rent |
| | | reduction of the obsolescence risk toward the implementation of more binding regulations concerning the energy expenditure in buildings | longer lifetime, depreciation |
| | **production of renewable energies on site** | possibility to find new revenues coming from selling the energy produced | impact on outlays |
| | Example of indicators: type and production of renewable energy, part of energy used produced on site | image | increased willingness to pay of the users |
| | | energetic independence and decreased sensibility relative to the energy prices | Likely impact on revenue growth |

| | | | |
|---|---|---|---|
| **Water** | **drinking water consumption** | decrease in expenses or in the rent (if lease "all expenses included") | possible impact on rent<br>calculation of the achievable savings that can be reflected in the rent |
| | Example of indicators: drinking water consumption | reduction of the obsolescence risk toward the implementation of more binding regulations concerning the energy expenditure in buildings | depreciation, discount when the building is resold, longer amortization time of the rehabilitation investments |
| | | changes in tax rules (increase in water charges for sewage treatment). | impact on outlays |
| | **sewage management** | decrease of drinking water consumption resulting in a decrease in charges | possible impact on rent.<br>calculation of potential savings that can be reflected the rent |
| | Example of indicators: quality of sewage | reduction of the obsolescence risk toward the implementation of more binding regulations concerning the energy expenditure in buildings | depreciation, discount when the building is resold, long amortization time of the rehabilitation investments |
| | | mitigation of the risk a sewage collection tax might be implemented | impact on outlays |
| **Waste (exploitation)** | **quantity of waste disposed of** | a weak quantity of disposal decreases the risk associated with the implementation of a tax for waste collection | impact on outlays |
| | Example of indicators: quantity of waste disposed of | | |
| | **recycling/valuation of disposal** | a weak quantity of disposal decreases the risk associated with the implementation of a tax for waste collection | impact on outlays |
| | Example of indicators: percentage of recycled disposal | reduction of the obsolescence risk toward the implementation of more binding regulations | depreciation, discount when the building is resold, longer amortization time of the rehabilitation investments |

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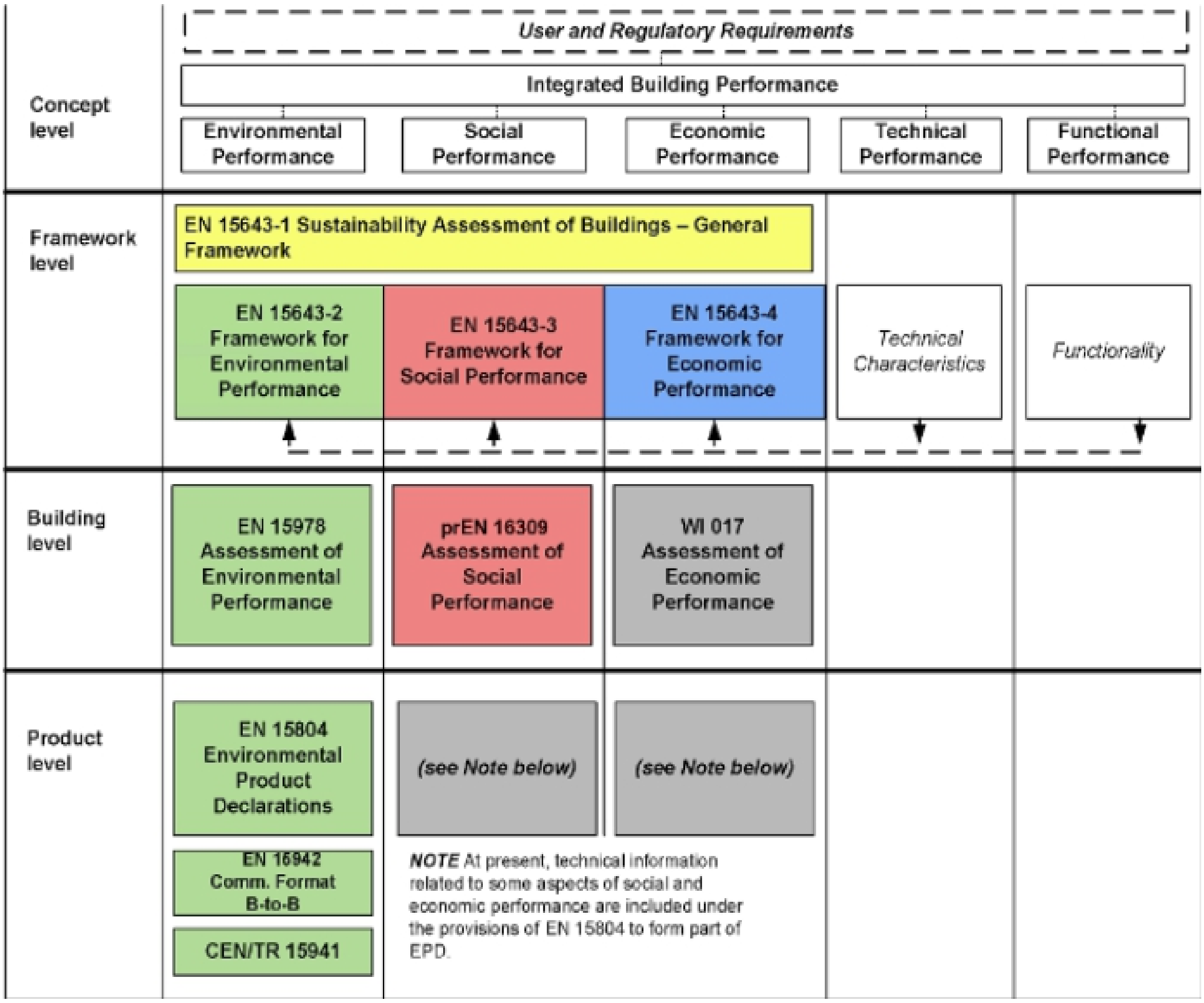
|---|---|---|---|
| confort / health | **visual comfort (natural light)** | higher rents for brighter housing | increased willingness to pay of the end users |
| | Example of indicators: percentage of surface where an artificial light is not needed during the day | increased productivity of workers | productivity gains can be reverberated on the rent and the selling price (through some savings on the labor costs for example) |
| | **Thermal comfort during summer** | anticipation of future regulations | depreciation, discount when the building is resold |
| | Example of indicators: number of days the temperature exceeds Tmax | anticipation of future regulations (example: European comfort rating) | depreciation, discount when the building is resold |
| | | increased productivity of workers | productivity gains can be reflected in the rent and the selling price (through some savings on the labor costs for example) |
| | **hydrothermal comfort** | increased productivity of workers | productivity gains can be reflected in the rent and the selling price (through some savings on the labor costs for example) |
| | Example of indicators: ventilation types, number of days the temperature is out of the comfort zone | anticipation of future regulations (example: European comfort rating) | depreciation, discount when the building is resold |
| | **acoustic comfort** | higher rents for soundproofed housing | increased willingness to pay from the end users |
| | Example of indicators: measure of the sound level (the case of building located in noisy area) | increased productivity of workers | productivity gains can be reflected in the rent and the selling price (through some savings on the labor costs for example) |
| | **indoor air quality** | increased productivity of workers | productivity gains can be reflected in the rent and the selling price (through some savings on the labor costs for example) |
| | Example of indicators: air renewal | preventing humidity and costs linked to re- | probability that a litigation might occur |
| biodiversity | **surface planting (wall, roofs, …)** | Image | willingness to pay of the end users |
| | Example of indicators: biotope area factor | | |
| | **on-site green spaces** | Image | willingness to pay of the end users, cost of land |
| | Example of indicators: biotope area factor, percentage of green spaces on the parcel | costs linked to a loss of living space | Calculation of the losses of the living space and monetization of these losses depending on the price per square meter |
| location/accessibility | public transportation node | | as an increased willingness to pay of the end users (company, institution) |
| | | gains on the carbon footprint linked to activities of the company which could impact the financial account of the company in case a tax was implemented or a carbon market created | through the price of avoided CO2 |
| | **proximity to a green space** | image | willingness to pay of the end users, cost of the land |
| | Example of indicators: park at less than 500 meters | owners and tenants ready to pay more to benefit from pleasant surroundings, including a nice view and proximity to green spaces | willingness to pay of the end users, cost of the land |
| | **proximity with the partners of the tenant** | gains on the travel costs | calculation of the travel costs savings related to the activity of the company |
| | Example of indicators: carbon footprint (activity perimeter), | gains on the carbon footprint linked to activities of the company which could impact the financial account of the company in case a tax was implemented or a carbon market created | through the price of avoided CO2 |
| | | Image, improvement of the relationship with clients | willingness to pay of the end users, cost of land |

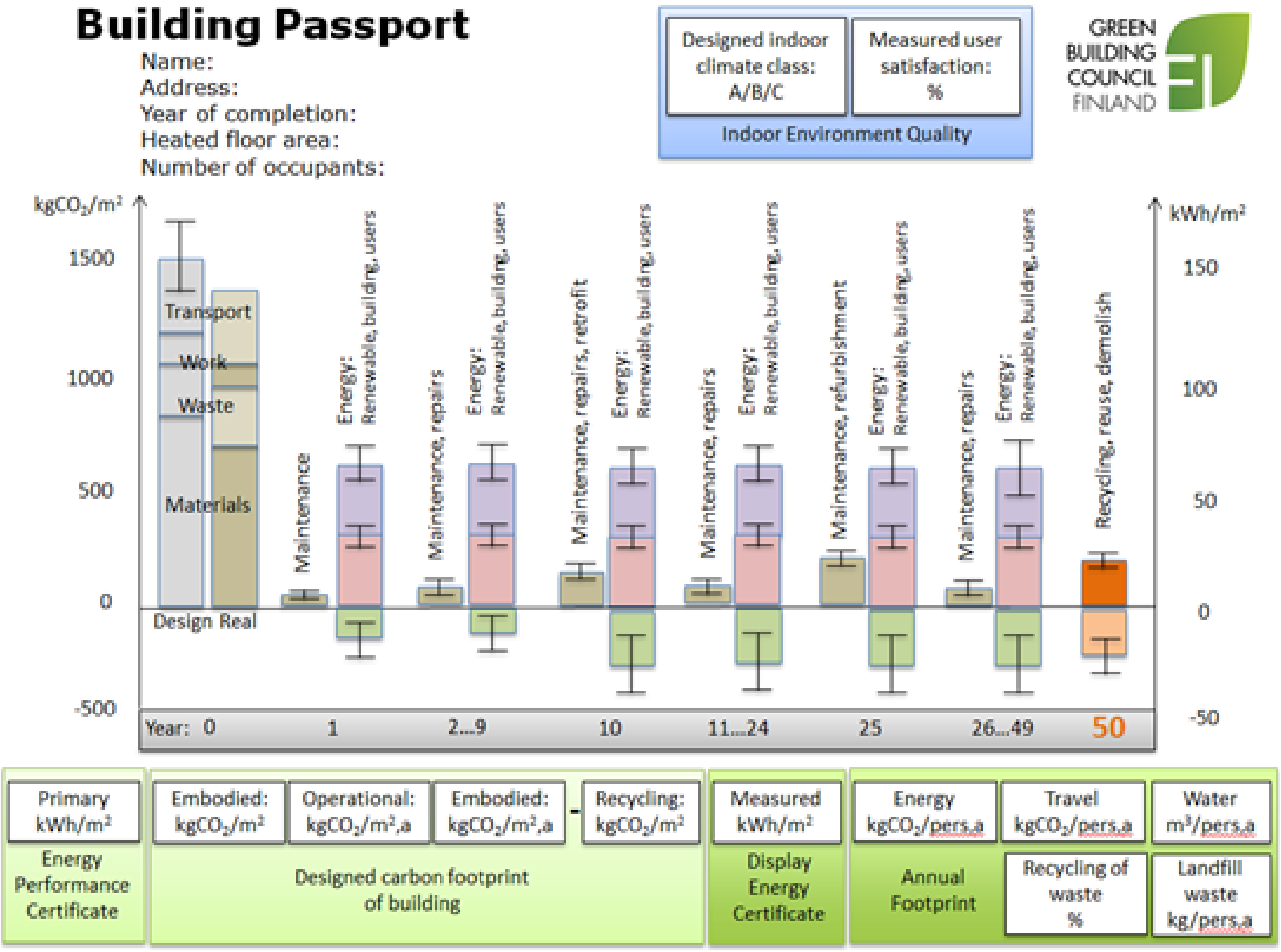
## Appendix 2: CEN/TC 350 standard overview

The CEN/TC 350 standard is a framework for the sustainability assessment of buildings in a life cycle approach. The standard distinguishes between environmental, social, economic, technical and functional performance and provides indicators to assess the sustainability impacts for these three first categories of performance linking indicators at a buildings levels and at a product level. If these standards are designed to foster the performance comparison, they do not set benchmarks of performance levels.

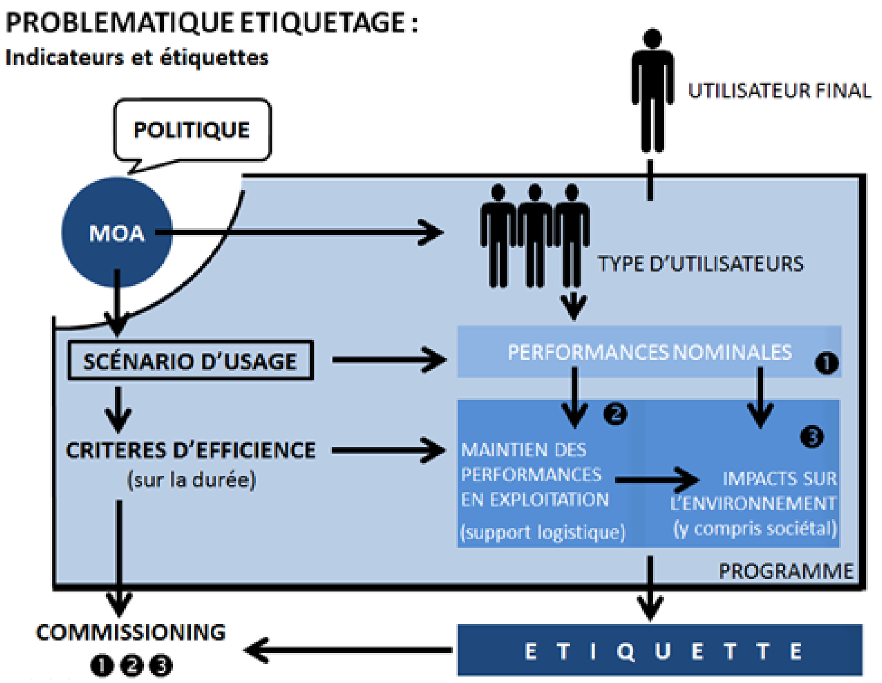



Source : http://portailgroupe.afnor.fr/public_espacenormalisation/CENTC350/standards_overview.html

## Appendix 3: Examples of building cards for building performance assessment initiatives




Source: Green Building Council Finland




Source: Christophe Gobin

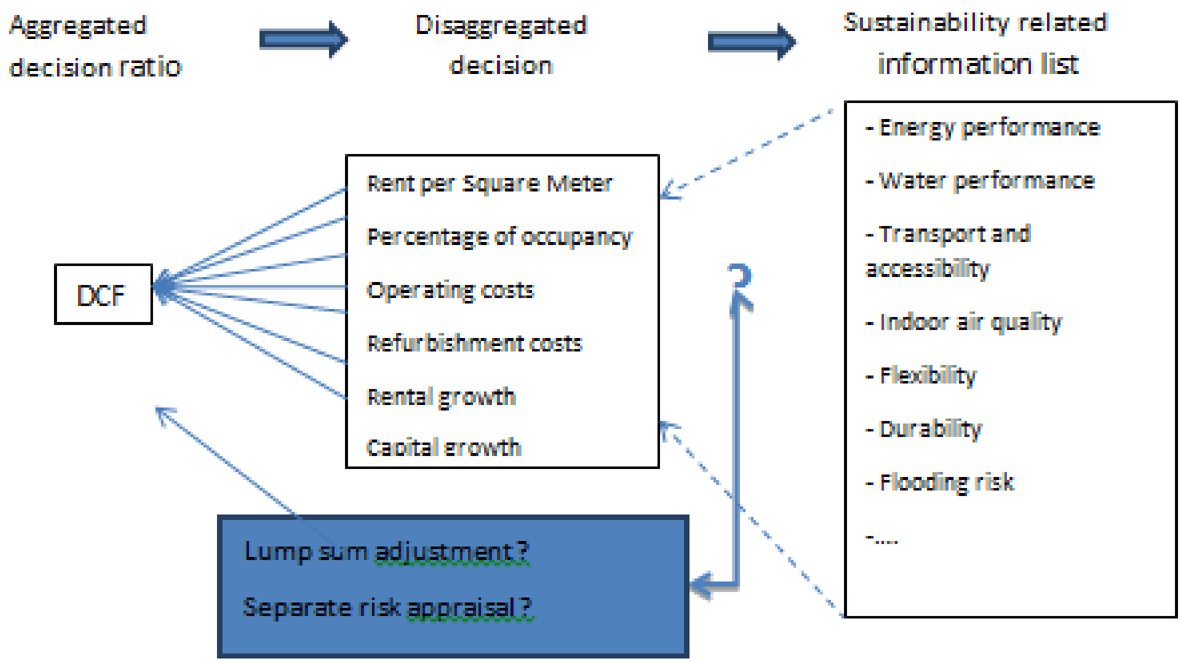
## Appendix 4 : Outline for SBA project interviews

### Aims

The interviews aimed to understand the investment decision process of institutional investors in order to determine how sustainability related information could be better integrated into risk and value assessments. To build further on the UNEP FI project on sustainability metrics, the questions focused on the methodologies, tools, required data and sources of information used in the decision-making process. Ultimately, the interviews helped to draft a preliminary common framework for the integration of sustainability related information into financial decision-making criteria, in particular the discounted cash flow methodology (DCF).

### General principles

In order to analyse actual financial process, interviews with a backward approach is suggested. Rather than asking investors about what information they collect within a long list of raw information, investors could be asked first about their investment decision tools before tracing back how sustainability-related information is incorporated.




## Interview framework

The interviews encompass the current state of DCF inputs, the sources of information used, and development needs for further integration of sustainability related information and uncertainty. The discussion should distinguish between decision process for asset selection, and decision process for improvements on existing portfolio.

1. **Question relating to the organization (company size, etc.) and to the interview partner (position, etc.)**
2. **Questions relating to the investment decision process**

Introductory questions to gain a broader understanding on the process during investment decision.

Ex:

- *What is the investment strategy and how is company level success measured?*
- *How is the company organised for investment decision?*

- *What departments are involved in the decision process?*
- *How does information flow between the various departments?*
- *What are relevant KPIs?*

=> Graphical representation of decision making processes and information flows including the parties/specialists involved for a) new building projects and b) in the case of refurbishments.

**3. Questions relating to methods and inputs used for investment decision**

Questions focused on decision criteria (in particular DCF) and calculation tools.

Ex:

*- What kinds of decision making methods are applied (in addition/as an alternative to DCF)?*

*- What decision criteria (aggregated ratio) is currently used for investment decision? For example: DCF, rate of return…*

*- How is it calculated and what parameters are used as inputs for this calculation? For example: Rents, capitalisation, rate, capex, exit yield, certificates…)*

*- How is each parameter obtained? For example: lump sum grid, internal tool, information provided by other serviced or external bodies…*

*- What information influences the appraisal of each parameter?*

*- How are results presented?*

=> Overview/information on the methods and tools applied.

**4. Questions relating to information sources**

Questions focused on the type of information used to appraise parameters and its source

Ex:

- *What information is collected to appraise parameters? Precisions on the type of information collected to describe market, location, building characteristics and cash flows.*
- *How is this information collected? Example: raw data collected internally, rating schemes, data asked to external parties, benchmarks with similar assets, regulatory information and certification …*
- *How is this information summarized/presented?*

**5. Questions relating to the appraisal of the uncertainty level**

Question focused on the management of uncertainty during the investment decision process

Ex:

- *How do you identify the key uncertainties related to investments?*
- *How do you account for the uncertainty during the assessment exercise?*
- *How do you account for investment flexibility (e.g., service flexibility, modifiability, energy production system) on the assessment exercise?*
- *How do you present the results? How do you explain this to others?*

**6. Questions relating to further developments and requirements for further integration**

Questions to understand barriers and needs for further integration of sustainability–related information. The aim could be to gather specifications for a more comprehensive tool.

Ex:

- *What further information do you reckon could also have an impact on the risk or value assessments, but has not yet been integrated? Why?*
- *What would you need to integrate more fully sustainability related information?*

**List of interviewees:**

- Abdahallah Ould Brahim (CBRE Valuation France)
- Jon Lovell and Miles Keeping (Deloitte Real Estate UK)
- Tatiana Bosteels (Hermes Real estate)
- Vincent Verdenne (BNP Paribas Valuation France)
- François Jussaume (IPD)
- Alain Minczeles, Arnaud Taverne, Joel Prohin et Helena Charrier (Caisse des Dépôts et des Consignations)
- Julian Dufoulon (Saint Gobain)
- Patrick Stekelorom (Allianz Real Estate France)
- Thomas Friedrich (Deka, Frankfurt)
- Anne Linnainsaari (Investment Director, Senate Properties)
- Veli-Pekka Tanhuanpää (Senior Vice President, Sponda Plc)

## Appendix 5: Workshop meeting minutes

**Meeting Date**

13/10/14

**Participants**

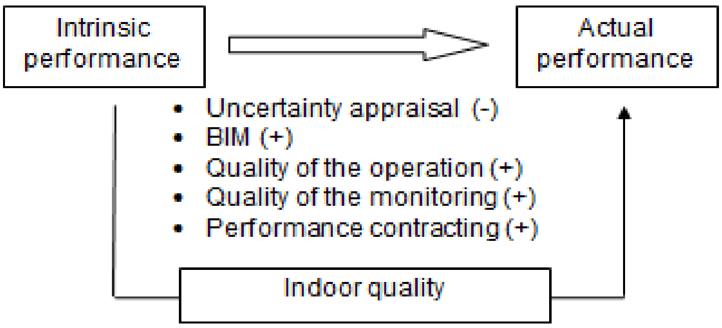
| Surname | First name | Company |
|---|---|---|
| Toth | Zsolt | RICS |
| Friedrich | Thomas | Deka Investment |
| Scherrenberg | Joel | BMC Advies |
| Ernest | David | Vinci Facilities |
| Gobin | Christophe | Vinci Construction |
| Meunier | Christelle | Crédit foncier |
| Widdad | Ali | Crédit foncier |
| Creamer | Mark | CBRE Valuation & Advisory |
| Stekelorom | Patrick | Allianz Real estate |
| Lützkendorf | Thomas | University of Karlsruhe |
| Lorenz | David | University of Karlsruhe |
| Kajander | Juho Kusti | Boost Brothers / Aalto University |
| Hovorka | Frank | Caisse des Dépôts |
| Kamelgarn | Yona | Novethic/ University Paris Dauphine |

**Main discussion during the workshop**

- **General outline and previous results**

- ***Better distinguish brand value resulting from the mere presence of a label and the value generated by the sustainability features.*** Occupants may reward the brand value of the label independently from the actual performance and its resulting benefits. This brand value will vary according to the building context and location and will depend on the tenants' CSR own policies (example of tenants who only rent labelled premises).

- ***Better distinguish intrinsic and actual performance in the value creation mechanisms.*** Building Identity cards (and BIM more generally) could help create a virtuous loop in the flow of information so that benefits at the operation stage can be better appraised at the design and construction stages. Energy performance contracting (guaranteed performance) could help. Conversely, the quality of the performance in use will depend of the quality of the design which must incorporate the planning of the performance monitoring during use.



- The starting point is a clear description of the building in a systemic fashion. Building sustainability features are part as the description of a building as a whole system. Traditional characteristics to describe building still apply, but need to be adapted into a new longer list of information.

- **Topic 1: Sustainability related information**

- **A better understanding of building performance as a whole should foster analysts and valuers to better value sustainability features.** However, sustainability is still often perceived as a separate topic. Valuers are aware that sustainability issues are important. They just don't know how to integrate it. In an ideal world, they would prefer to have simple figures for the different types of property that they could directly use in their valuation exercises. Among valuers, there is a lack of information and a lack of interest for sustainability. They rather focus on costs by verifying how the subject property compares with energy benchmarks.

- **Data is still mainly collected on a punctual basis (for transactions, or on a yearly basis by external parties) with no systematic approach that could allow investors to integrate data collection in building management processes. The cost of systematic data collection would probably be lower than the costs of punctual due diligences required to start each time from scratch.**

Currently, many investors do not have mechanism to integrate sustainability systematically. Adjustments for sustainability are made on a punctual basis after discussion with the various experts. As a first step, some are just starting to organize a system to collect the information that would be required.

Several investors ask third parties consultants to collect the required information every year for them. Several information checklists may be used for DCF calculations according to the different type of occupancy scenarios and the time horizon of detention of the asset.

Key data are mainly collected at transaction (sale or purchase).

Technical information could be collected during the building life cyle and be used as need arises. For example, technical documentation is mandatory in France when the building is delivered. However, it has usually not been stored correctly and is usually not used.

- ***List of sustainability information highlighted by the participants:***

| Performance/quality characteristics | Comments (reliability of information, source) |
|---|---|
| Energy consumption | Collected from building monitoring, from tenants through green leases |
| Energy costs | |
| Maintenance costs | |
| Image/culture and location | As part of valuers current appraisal |
| Asbestos, lead | A structural survey is already done by valuers |
| State of the equipment | A structural survey is already done by valuers |
| Churn rate | |
| Churn cost | |
| Comfort level | Often only appraised through target temperatures |
| Environmental performance | Provided by environmental assessments |

**- Recommendations: Data should be collected directly from the people who have the information, namely designers and contractors for new buildings, and facility managers for existing buildings. The verification of this information by third parties would increase the value of the data.**

Facility managers could provide date for the in use stage, in particular as regards the state of the equipment.

However, they are usually not asked (PM linked between the investors and the facility managers).

- **Clarify the different targets to collect information. Information may be collected for reporting purposes only. For valuation exercises, raw data are or the mere presence of an environmental assessment are not sufficient. Understanding the context, the comfort level and the building use is important to integrate said information in value calculations.**

If some investors rest their sustainability policies on environmental assessments (in particular in use certification schemes), other prefer to focus on environmental metrics only.

The value of environmental assessments results rests in the fact that they offer a new / additional source of information (when investigating beyond the overall score) and in their brand value. SuperBuldings project and the new generation of certification schemes should help create a clearer links between asset value and the presence of a certification schemes.

- **Performance measurement corresponds to a three-step approach: 1/ data collection 2/ Assessing quality of data 3/ plausibility of data**

- **Topic 2: integrating sustainability into DCF framework**
  - Key parameters already adjusted by the participants for DCF on sustainable buildings
  - retrofit costs to achieve a given performance,
  - higher rents,
  - shorter vacancy period,
  - the yield is not always adjusted,
  - energy and other utility costs.

- **Standardized framework. A single standardized framework is not possible since the format depends on the building types and the purpose of the valuation exercises. However, it is possible to reach an agreement on the parameters that should necessarily appear.** DCF layout will differ according to the type of buildings (commercial, office, residential), according to the countries and the valuation firms. For example, utilities are never accounted for in the Dutch DCF.

- **Terminal value and DCF duration:** In public buildings, the duration is based on the remaining life of the building so that the terminal value is only the value of the land. The length of the lease could also be reflected.

- **Identifying the impact of sustainability performance compared to the impact of other factors will depend on the building context. The first step is thus to increase transparency to understand whether it has been accounted for or not (independently from the magnitude of the impact).**

- **Distinguish double counting and multiple effects**. Standardizing the way sustainability should be accounted for could help be more transparent about multiple effects and double counting.

- **Lease structure:** The lease is both and input and an output. Sustainability performance can help have longer lease. Conversely, longer leases can help investors invest in sustainability feature.

- **Maintenance costs need to be appraised separately from replacement costs and from retrofit costs…** Replacement costs depend on the reliability of the system (failure per hours of running time) and the maintainability (the fact that the building is easy to maintain). The impact may be positive or negative according to whether the building is high tech or low tech.

- **Utilities costs should be present even though they may not be paid by investors. Energy costs forecasts**

**could be another interesting piece of information.** Utilities costs should be distinguished between costs paid by investors and owners. For owners, utilities costs still inform on the maintenance and replacement that will be required.

- **Distinction between maintenance costs and replacement costs…** Replacement costs depend on the reliability of the system (failure per hours of running time) and the maintainability (the fact that the building is easy to maintain).

- **Discount rate should only be used for adjustments that cannot be made explicit.**

- **Topic 3: Accounting for uncertainty**

  **-** Distinguish risks and uncertainties

  - Outputs of MC simulations:

  1. Present the uncertainties associated with the calculations
  2. Appraise the potential for earning between different retrofit scenarios and compare the different risks profile
  3. Demonstrate the impact of information availability

**Mixed reception of MC simulations by participants' uptake on MC simulations. The outputs raised interests but the implementation appeared as too complex. To bypass this potential lukewarm welcome, the final report could insist on the fact that risk departments are already using such methodologies and could present this methodology as a sensitivity analysis.**

Several participants showed interest for MC simulations but deemed it too complex for valuers. Investors are nearly just introducing the requirement to compute and compare different scenarios. They have not looked into the impact on the value distribution yet.
It was thus suggested to present MC as a tool to asses risk profile and sensitivity analysis. Indeed, risk departments of large investment firms already use similar methods. MC simulations are already used to analyze the risks of losing; they could now also be used to appraise the chance of potential earning

- **Topic 4: Accounting for flexibility**

- **Distinguish flexibility and adaptability**: Flexibility within a building corresponds to the capacity of a building to be operated in different ways for the same overall use. Adaptability refers to its usability by third parties.
- **How to measure flexibility? There is no good measure for flexibility either technically or financially.** Flexibility is currently being appraised by considering windows width, absence of columns and ceiling height. Ideally, flexibility should account for the capacity of the building to adapt to market changes, and should translate into better marketability. There is no standardized methodology to technically assess it.
- **Real options to compute the value flexibility may serve different purpose. First, it may be used as a decision tool to improve the design of a building. Second, it can be used as a complementary tool to measure a flexibility value that will be added to the DCF calculation.**
- **The value of flexibility could be integrated as an additional terms in a DCF framework to specifically appraise a particular building feature. It does not impact the rest of the DCF calculation.**

**Key outputs of the workshop**
The following section details the key observations the research team has compiled from the workshop.

List of sustainability related information required for the integration into DCF methodologies

| Performance/quality | Source of information and reliability |
|---|---|
| - **Occupation quality** | |
| Image/culture and location | Part of valuers' current appraisal |
| Comfort level | Often appraised through target temperatures. |
| Building related services | Part of valuers' current appraisal |
| Serviceability | Part of valuers' current appraisal |
| Global cost per working station | (for office buildings) |
| - **Technical quality** | |
| Maintenance costs including replacement costs and running costs | Ease of cleaning, commissioning, high tech or low tech building ,report on corrective maintenance |
| State of the equipment | Information from facility managers, Part of valuers' current appraisal |
| Reliability of the equipment | failure per hours of running time from facility managers |
| Modernisation costs | dismantle and recycling of building materials |
| - **Flexibility and adaptability** | |
| Space efficiency (windows width, absence of columns, ceilings heights) | Part of valuers' current appraisal |
| Churn rate | |
| Churn cost | |
| - **Environmental quality** | |
| Environmental performance | Environmental assessments |
| Energy consumption | EPC or DPC , energy simulation, actual consumption |
| Energy costs | Green leases |
| Source of energy | |
| Asbestos, lead | Part of valuers' current appraisal |
| Resilience against natural and climate hazard | Part of valuers' current appraisal |

***These for the consideration of the quality and sustainability of buildings within DCF***

- A separate consideration of overall building quality (in the sense of value-influencing building characteristics) and sustainability-related attributes does no longer make sense. Instead, sustainability-related attributes like environmental- and health-friendliness, energy and resource efficiency, etc. can be treated as elements/constituents of an "extended" overall building quality.

- If possible, relevant (i.e. value-influencing) quality characteristics of a building shall be translated into impacts on cash flow.

- Characteristics and attributes which cannot directly be taken into account within the modelling of the cash flow shall be factored into the determination of the discount and capitalisation rate.
- Simultaneous consideration of quality characteristics within several DCF input parameters (e.g. rent, discount and/or cap rate) is valid and appropriate (in order to account for "multi-effects"). But only if this can be justified (in order to avoid "double-counting").

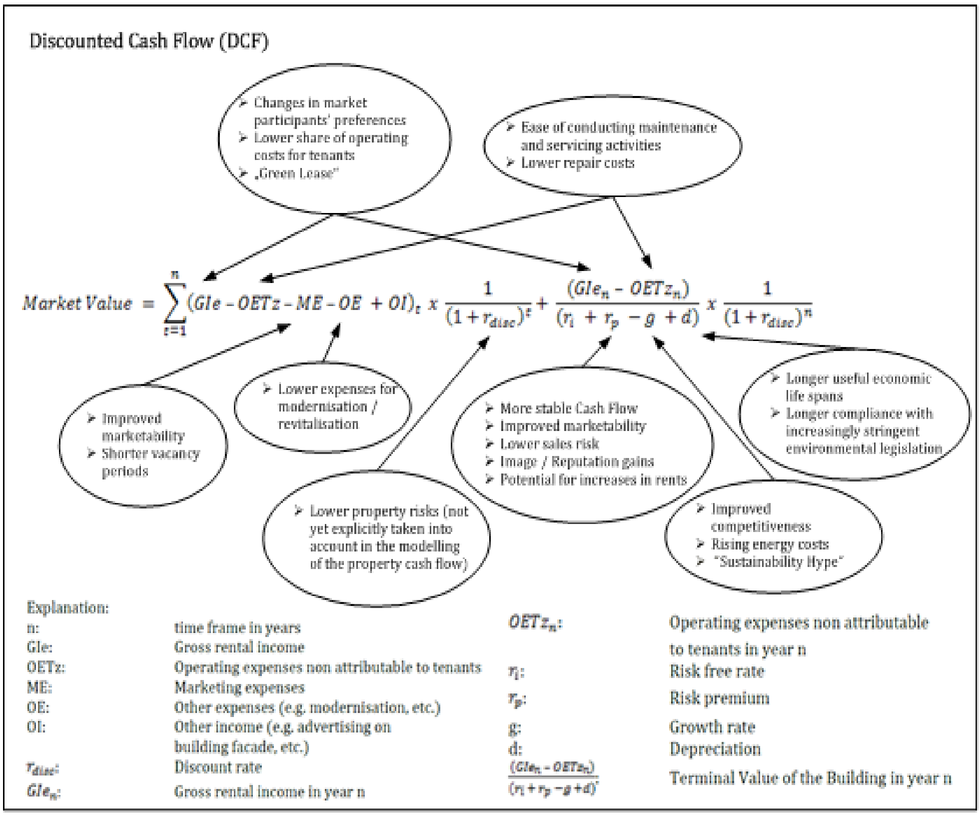
- Within a two-phase DCF model, the time span under consideration during the first phase is usually between 5 and 15 years. A time span of 10 years is recommended.

- There is no standard format for DCF calculations. Different formats are used for different building types, types of usage and also within different regions; this reflects the particularities of the different real estate sub-markets. However, in order to reach a uniform/generic basic system, the recommendation is to find agreement on the listing of possible DCF input parameters and the quality characteristics that should be reflected through each input parameter. This listing shall contain/embrace all possible input parameters to form a basis for a standardised DCF framework. Within the actual DCF calculation, single input parameters from the full listing shall then be enabled or disabled.

- The DCF methodology particularly lends itself to include data/information from other methodologies; e.g. life cycle costing (as an LCC in a widened sense including incoming payments) or full financial plans.

- In special cases, the results of the real options method can be integrated into / added to the DCF results
All inputs into a DCF calculation are uncertain; to a lessor or greater extent, depending on the quality of the underlying information and the reliability of the information source. This circumstance needs to be reflected when presenting the DCF results. The method of choice in this regard is Monte-Carlo simulations.

## Appendix 6: Examples of the impact of sustainability on the input parameters in the Discounted Cash Flow (DCF) approach




Source: Lorenz, D. and Lützkendorf, T., 2011, Sustainability and Property Valuation – Systematisation of existing approaches and recommendations for future action, Journal of Property Investment & Finance, Vol. 29, No. 6, pp. 644–676

## Appendix 7: List of performance / quality characteristics (source UNEF FI Metrics report, 2014)

1. Functional quality
1.1 Serviceability (fitness for purpose, usability)
1.2 Space efficiency
2. Cultural and social quality – part I
2.1 Aesthetic quality
2.2 Urban design quality
2.3 Cultural value
3. Cultural and social quality – part II
3.1 Health & well-being
3.2 Indoor air quality
3.3 Comfort (thermal, visual, acoustic, olfactory (part of indoor air quality))
3.4 User safety
3.5 User participation and control
3.6 Accessibility (to and inside the building)
4. Technical quality
4.1 Structural safety
4.2 Fire protection
4.3 Noise protection
4.4 Moisture protection
4.5 Maintainability
4.6 Flexibility and adaptability (also in the sense of suitability for re-use and third-party usability)
4.7 Ease of cleaning
4.8 Durability
4.9 Resilience against natural and man-made hazards
4.10 Design for deconstruction and recyclability
5. Environmental quality
5.1 Energy performance
5.2 Resource depletion
5.3 GHG-emissions and GWP
5.4 Other impacts on the global and local environment including risks to the local environment
5.5 Land use change and sealing
5.6 Water consumption
5.7 Wastewater
5.8 Waste (from construction activities)
5.9 [Waste (user related)]
6. Economic quality
6.1Life cycle costs


Thank
You!

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Studies & Research 2015

Sustainability thresholds
generating value

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