Multi-Dimensional Approaches to the Development of Sustainable Real Estate Valuation Principles

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Abstract. The dimensions of real estate which begin as spatial within time added, and the time being includes ecological and economic self-history besides the sociality with cultural capitalized values influenced by technology and ethics. The aim of this paper, is to discuss the philosophy of value and valuation methods described for sustainable real estate development within its dimensions introduced here as $\Sigma$SoCuT$\Xi$ ($\Sigma$ stands for eco-system, economic and ethics; SoCuT stand for socio-cultural values and T also for technical, and $\Xi$ is history which stands also as a base of first three concepts) which the environment built by Anthropocene view. Built environment, in a way, is strategically designed by the construction industry, which is shaping and re-shaping the environment, which has the most powerful influence on the “economic capital and environment” in terms of adding value to the real estate leverage in the significance of genius logi. The so-called sustainable real estate has to power the highest and best use with functionality, energy efficiency, resource intensity, environmental compatibility, health, socio-cultural aspects, life cycle coast and technical quality to measure value/earning/worth. Value of sustainable real estate development, composed of the architectural design of built environment within sustainable architectural principles, approaches, constructional criteria, and methods. The evaluation of this composition includes, the investment on potential idea pending the realization of real estate, which is called earned capital, and the captured value as intangible assets at any stage of life-cycle of the real estate is also called earning/worth. The dimensions which are hidden in the facts of development of sustainable real estate valuation design which are captured in the $\Sigma$SoCuT$\Xi$ will be discussed by comparison as the method of sustainable architectural design, application, and life-cycle of a real estate and its valuation principles. Comparing the principles both the architectural design includes the engineering projects and the way of real estate valuation, we as designers may lead also the strategical perspective of economic investment. As a conclusion, the possible cross-info flow of these approaches has to become the shared values in the strategical planning, flow from concept to concept to keep the dimensions of real estate development in the sustainable reality.

1. Introduction

The environment that has agreed to be sustainable includes the world of ecology within human structured values. Ecology itself have the balance incontrovertibly. Furthermore, any human activity needs own-balanced long-term vision to enhance the value chain. Sustainability needs to be embodied in shared, added and future values surely depending on the time span with legacy. The built environment is inevitable if it is to design and construct by preserving the soul of the space and considering the availability, harmony, and transformation of scarce resources. The ones of time sharing reflections in the land and built environment are the concerns of property. The property has many elements as assets, land and real estate depending on ownership and re-defined capital, which also includes the nature, human power itself and intellectuality in an innovative way as cultural, social and symbolic since the
concept of capital re-written by Bourdieu in 1986 [1]. Due to the reason that nowadays wealth is as important as health [2], economic value is being supported by all these kinds of capitals also as a part of the property investment [3] subjected to valuation (the word appraising mostly preferred in the United States and Canada).

Capital investment in the construction sector, which is producing and spearheading many other sectors, is important for the sector to keep its necessary subclasses in balance in order to avoid the profitable options defined only in the economy without transforming the demands of the mass. All these concepts are “worth” to be achieved when mixed in a patera, and with formed environmental, socio-cultural and economic.

The aim of the research is to bridge the gap between dimensions of value created by architectural design and sustainable real estate development valuation with sustainability assessment tools to evaluate with measured capitals. Concepts of the strategical planning process, sustainability, and value, which express a direct action (phenomenon) attributed such as architectural design, financial feasibility, and experiences also, are compared and discussed to constitute the sustainable real estate valuation process. The reason for global and local crisis depends on the shared values, yet created to become sustainable value chain from marginal sense to optimized naturalism. The evolution of output, which is the final product to be consumed in the linear economy, nowadays are being treated as an input in the circular economy, regarded as a starting point for another action. The action such as the resultant capital and value aim to carry out a fertile regeneration in terms of its contents, recommendations, and results.

2. Assumptions and findings of multi-dimensional research
The environment as the patera itself, primarily, includes different type of concepts from different disciplines of science. The construction world shapes this study and the world within the knowledge of ecology, economics, and ethics with educational intelligence, socio-cultural parameters with legal issues, historical background and technology evaluated in time. Accumulation of these concepts creates scales, which are followed by capital all end up as added, shared, and future values. Moreover, in International Valuation Standards (IVS) the assets are considered mainly as business and business interests, intangible assets, plant and equipment, real property interest, development property (which is subjected in this paper as real estate development) and financial instruments. While, considering the samples that make up the dimensions, within the scope of the Sustainability Metrics report, sustainability, which can be used as a tool to fulfil its environmental, social and managerial responsibilities, can address the financial risk impacts and discusses its use as a general quality assurance tool and mechanism [4]. There are many monographs written on sustainable real estate development [5]. Also, acronyms like equations as methodological descriptions. Such as PESTLE which stands for political, economic, social, technological, ecological and legal factors [6], and SuFiQuad which stands for sustainable, financial, quality for dwelling type of property [7]. The investors and financers, the designers, the builders, the managers and the occupants with the valuers (appraisers) who measures the fair value, all are the key actors of the real estate development in a creative sense which consists of multi-dimensions.

2.1. The architecture of design, project management, and strategic planning
Since the archi compound of origin, principles, primacy, and tech means the craftsman, Karatani implies the term architecture by a quotation from Plato by poieses originally meant simply creation in the Architecture as Metaphor Language, Number, Money at the included section “The Will to Architecture” [8]. Vitruvius, in his book De Architectura, which can be regarded as the first discussion on the architectural attitude, has defined four concepts (Table 1a) that will enable the building to exist in the future, based on usefulness. These concepts meant the value of the architectural transformation of design in the mid of 1st Century AD. In the mid of second millennium, De Architectura was reinterpreted by Alberti and De re Aedificatoria was published. Alberti, in this restructured commentary, has set the value on three key pillars (Table 1b).
Table 1. Architectural design principles by (a) Vitruvius and (b) Alberti

| De Architectura by Vitruvius | De re Aedificatoria by Alberti |
|------------------------------|--------------------------------|
| Utilitas                     | usability                      |
| Firmitas                     | durability                      |
| Claritas                     | unambiguity                     |
| Venustas                     | lasting beauty                  |
|                              | Perpetuita                      |
|                              | Comodita                        |
|                              | Belleza                         |

The architecture of sustainable design includes the flexible (elastic) and modular type system approaches with inner courts (atriums), and principles for space requirements [9] as conservative, efficient use of the sources and healthy spaces and strategic planning matrix in project management [10] with the ease of integrated Building Information Modelling (BIM). BIM as a software that is designed as data input by parametric modelling, not Non-Uniform Rational Basis Spline (NURBS) model, so that each structural member is presented an interface that can be expressed on an individual scale [11]. This feature also appears to be used to improve the size of the 7-dimensional BIM model. Strategic planning matrix consists of models depends on scales (Table 2). The life cycle of property with ownership cycles and design of investment programs also consists of models. The envisage market participants should be structured within the framework of the investment program’s life cycle as elements as the institutional real estate investment framework, processes, capital provider’s decision processes and property owners like architects and engineers.

Table 2. Strategical planning models [12] based on scales

| Scales                        | Models                      |
|-------------------------------|-----------------------------|
| Economy                       | Economic Models             |
| Socio-cultural                | Agency Models               |
| Legal                         | Structural Models           |
| Technology/Time/Historic heritage | Event sequence Models     |
|                              | System Models a             |

a 4 models’ integrated approach.

Although the developments in technology and material science seem to constitute and contribute to sustainability in architectural design, in reality, it is expressed by discussions over examples of local architecture that are not actually the case. Mardin and Cappadocia (Turkey), Kameron, Marrakech, Morocco, Malaysia, Iran, Mexico, each one as an example has created living space culture using a local tissue, replacing the traditional architectural values. These vernacular methods are still used all over the world the way to remember an important step towards a sustainable built environment, which should be considered as important as a result [13]. Briefly, architectural responsibilities might be re-written within the context of sustainability [14].

2.2. The architecture of real estate development

Real estate development (RED) is a strategic process from land acquisition to redevelopment compare to sustainable life cycle with the actors and instruments depends on an idea at the beginning. The architecture of the analytical thinking approach is based on the investment and risk approaches, the design investment, the costs and revenues, the developed entity itself and the monetary aggregates, the space of investment between the space consumers and the space producers, entrepreneurial approach. The stages of the development in design structure matrix (DSM) also were discussed with five specialist project managers and six items were identified [10]: The development starts with the first idea followed by applicability, pre-construction, construction, balancing and asset management and/or sales (Figure 1).
3. Real estate valuation design approaches, principles, and methods

Worldwide, each country has the authority to intervene legislation in the process and method under its own property and assets, yet the IVS approaches, methods, analyses, and applications are accepted in general, which is published by the International Valuation Standards Council (IVSC). The valuation approaches discussed in IVS Valuation Approaches and Methods (105) are titled as market, income, and cost as well as the characteristics and preferences of the assets. The term “valuation” is used to describe the method of determining the value of properties, assets such as real estate development and sustainable real estate development projects which are designed by specialists as architects, engineers, and finance world etc. designers.

The Valuation – Global Standards 2017 by The Royal Institution of Chartered Surveyors’ (RICS) the valuation practice guidance (VPGAs) with IVS includes the same approaches and methods. The European Association of Valuers (TEGoVA) analyses the market value (sales and income) as a value approach and applied methods to the valuation. The framework of the Uniform Standards of Professional Appraisal Practice (USPAP) published by The Appraisal Foundation (APF) and The Appraisal Practices Board (APB) of Appraisal Institute (AI), explains the valuation methods, under the title of Appraisal Advisories, which accordingly mentions the mobility and the comparison of needs, accordingly. In the American Society of Appraisers (ASA), the Appraisal Principles and Code of Ethics, all approaches are tailored to the needs process. Considering the basic principles of AI appraising, how to analyze approaches and methods and how to develop appraisal awareness are being investigated as a pioneering subject including education and applications [16]. The concept of value elaborated by these institutes deals with the value conception that arises as a result of real estate development in a clearer and detailed perspective of the main framework of value by IVS. Investment value, interest for secured lending, securitization purposes and the alternative fund managers’ directives type of values are defined for individual or massive property and real estate interests in the financial statements to general trade and real estate market [17].

According to the needs of valuation and its principles, the dimensions of the real estate development, have bases of value as outputs, are discussed in the sector established. The bases of value analyzed with affecting factors on economic principles depend on the premise of value / assumed value, which is described in the valuation standards, are also discussed in the academy and the market [17-19], worldwide (Figure 2). While the main principles of real estate valuation are based on the economic principles, in this study, it is thought that principles actually embrace sustainability already, by using more comprehensive and dynamic methods which are introduced in the near past.

![Figure 1. Real estate development in 7 steps [11] and 10 stepped matrixes [15]](image-url)
Figure 2. Dimensions of value at valuation process; bases of value and premise of value with value-affecting factors on the valuation date

3.1. Basic principles of valuation approaches
It is noteworthy that the valuation principles, when viewed from the perspective of sustainability and value concepts, have a hidden sustainability. In the valuation process, sustainability provides an effective contribution to the development and improve the valuation approaches in the internalization and valuation of the basic principles (Table 3) as well as the real estate development [17], [18].

| Table 3. Basic principles of valuation |
|----------------------------------------|
| **The anticipation principle:** It can be called as “Sprouting assets” [21]. Assuming that the expected value of the assets subject to valuation will change from its present investment value to a time-dependent value function of the assets. In terms of real estate development, it seems that flexible space design represents trust. Assets that can meet the expectations in the future, especially in mixed real estate development projects compared to the most suitable mixed-asset portfolios are seemed whose risk is balanced, sustainable and be able to look ahead more securely. |
| **The balance principle:** If the entropy is balanced in the real estate development process with production factors (lowest investment, most efficient and productive return), the selected land value for the development of the real estate is at the highest level, named equilibrium. The negative loss of equilibrium in entropy, conservation and even affirmation (profit) are studied by the presence of sustainability in the equations of existence. |
| **The change principle:** “No physical or economic condition on earth will remain constant” (from the quote of Heraclitus “There is nothing permanent except change”). |
| **The competition policy:** For conscious investors and buyers, it is the situation that occurs when the demand for supplies on the market is low. |
| **Conformity principle and premium progression and regression:** As in compliance with the surrounding environment during design, the criterion is the same in the valuation process. Real estate property, which does not adapt, loses its charm. |
| **Contribution principle:** Any change in the value of an investment is considered as a measure of change in market value. When considered together with the principle of conformity and premium earning / loss, it is advisable to mention renewal or restructuring - in the case of all development projects, regional investment is much affirmative than singularity. |
The externality principle: Entropy and balance examined at the beginning of equilibrium, all other cases can be defined as factors affecting equilibrium according to the principle of change in equation (ceteris paribus). Changes in production + economy + social factors are the inclusion of balance and sustainability, externally.

Supply and demand principle: If competition principle and level of consciousness are taken into consideration, it is the sole principle that balance principle can operate on, in real estate market.

The principle of substitution: The demand is that varies in the similar real estates, can be bought in the market irrespective of the cost. When the level of consciousness, production standards and certification increase, the cost enhancing facts of the sustainable real estate will adapt to market equilibrium. When a property can be easily replaced by another, the value of such property tends to be set by the cost of acquiring an equally desirable substitute property; comparing market value, cost, or income, the principle of substitution is basic to each of the three approaches to value.

Conjuncture periods: The real estate cycle is defined as “the ups and downs in the real production volume of the economy”, and the market cycles [17]. Starting from 1970s, the real estate and assets’ cycles of the real estate market are monitored for each decade and reflected in a graphical model which the overall physical and monetary interactions could be predicted. In general, within all the principles, the cycles reflect the life cycle of the market as well as the life cycle of the properties [22].

3.2. Valuation approaches and methods of real estate development
Dimensions of the sustainable real estate have a synergistic value of sustainable design for centuries as developed assets and created value. Scales, current capital concepts, and value are the key factors compared with market, income and cost approaches. The methods used with these three approaches depends on mentioned external value-affecting factors, which describe mainly the discount rate and risk perception (Table 4).

| Approaches                          | Methods                                      | Measurement (Scales) |
|------------------------------------|----------------------------------------------|----------------------|
| Market (Sales Comparison Approach) | Comparable transactions method (direct value comparison) | Direct Capitalization, Annually (Gross-Net / Yields-Cap Rate / Adjustments) |
|                                    | Extraction (conversion) technic              |                      |
|                                    | Trend analysis                               |                      |
|                                    | Rating and development possibility analysis  |                      |
| Income                             | Explicit Forecast Period                     |                      |
|                                    | Cash Flow Forecast                           |                      |
|                                    | Terminal Value                               |                      |
|                                    | Gordon Growth Model/Constant Grow Model     |                      |
|                                    | Market Approach/Exit Value                  |                      |
|                                    | Salvage Value/Disposal Cost                 |                      |
| Cost                               | Replacement Cost                             |                      |
|                                    | Reproduction Cost                           |                      |
|                                    | Summation Method                             |                      |
|                                    | Depreciation/Obsolescence                   |                      |
|                                    | Adjustments                                 |                      |

3.3. Valuation approaches and methods of sustainable real estate development
As the main framework, IVS mentions to evaluate existing assets as a development property manner “sustainability and any client requirements in relation to green buildings” is the fact to valuer’s knowledge (410.100/(k)). RICS Valuation – Global Standards 2017 in the valuation practice guidance–applications (VPGAs) 8 and Valuation Technical and Performance Standards (VPS) concerns with valuation of real property interests. Inspection of valuer’s includes sustainability assessing the implications for the value of significant increase and the market impact rates increasing day by day of which valuers should be aware. The energy efficiency is part of the property valuation by standards of TeGoVA. The concept of green value, which is included and described within all of the methods, by the association are defined suitable for the valuation of sustainable buildings. Subjects of APB
Valuation Advisory (#6 and #7) are the background and core competency of valuation of green and high-performance property on integration, rating systems, scores and certifications, energy modelling, benchmarking and auditing, policy initiatives and regulations, financing incentives and green leases, also considered by USPAP influences by expectations for appraisers/thresholds for competence.

4. The architecture of reflected sustainable scaled values

These scaled capitals, which create value included in ‘figure 1’, are all interconnected to create sustainability subjected to the built environment (Table 5). Considering the annual report of Washington D.C. published by the Sustainable Energy Unit in 2015, 185,250 hours of green labor are introduced and $18.6 million is invested, herewith it is stated that the real estate in the region is earning $96.6 million during the life cycle. As market competition increases and costs fall, the production is encouraged.

Table 5. Architecture of sustainable environment design equation and dimensions of value-action

| ΣSoCuT | Scale | Capital | Level | Value |
|-------|-------|---------|-------|-------|
| Σ     | Eco-system Economy Ethics / Education | Natural | Decision Making | Added Value |
| SoCuT | Social Cultural Legal | Human (Intellectual Entrepreneur Creative) | | |
| T     | Technology / Practice | Innovation | Investment | Future Value |
| Ξ     | Time | Circular Economy | Realization | |
| Inputs | Outputs | | | |

Value Planning’s time-dependent value change is based on the cost-effectiveness of Value Planning recommendations and explores the usability of sustainability dimensions to persuade customers. The perception that sustainability adds cost to a project is likely to be consistent with Value Engineering work, which focuses on discarding unnecessary costs in ‘Figure 3’. With sustainable principles, Value Planning has the potential to reduce the entire life cycle cost of a property by eliminating unnecessary costs [23]. Besides general approaches and defined methods, also different specific point of views are discussed like life cycle assessment (LCA) of real estate market, the economic life of buildings, and construction materials [24]-[26].

It is stated by Lützkendorf and Lorenz (2005) that the “Sustainable Building Investment through Sustainable Property Investment: Valuing Sustainable Buildings through Property Performance Assessment” will create a more robust based approach to the value of sustainability criteria to be added to classical valuation methods. It is emphasized that the relationship between sustainable design and risk management will have an added power. Furthermore, the opportunities provided by this synergy are identified, and that the development of possibilities for lending and real estate risk assessment for insurance purposes can be based on net data. According to the purpose of the requested valuation design, the valuation methods are compared with the existing building, management quality, renovation and
adaptation designs, demolition and waste planning stages in the study, which includes identification of the methods to be needed at the life cycle stages [27].

![Time-dependent value change graph in value planning](image)

**Figure 3.** Time-dependent value change graph in value planning [23]

Integration Sustainability and Green Building into the Appraisal Process has raised the issue that the current non-sustainable building stock could pose a risk to the market value that gives the sustainable build-up of value [28]. Another risk posed by the real estate market is that the discounted cash flow method used to calculate sustainability and defined as the most appropriate method [5] is defined as a method that is not used or not known while small-scale real estate and assets. While the stock markets from China (Shanghai), United States (Dow Jones - ReobecoSAM) and Turkey (Borsa İstanbul BIST - EIRIS) are examined, the sustainability index is especially established in the twenty-first century. Particularly it is identified that mainly real estate investment trusts, which have massive and specific portfolios, prefers to invest in sustainable assets because of the defined low risk in addition to mobility and high yield that has been found to be in demand (Figure 4).

![Comparison of global property investment earnings and sustainable investment in between 2007-2017](image)

**Figure 4.** Comparison of global property investment earnings and sustainable investment in between 2007-2017 (Dow Jones World Diversified Sustainability Indicators on a global basis)
Many main exhibitors, even in 2005, provided a clear explanation of the factors that boosted green building values [21]:

- The credibility of the tenant’s existence,
- Determined higher rent or sales value,
- Prevention of loss of space,
- Fewer operating and maintenance costs,
- Being able to become a point of attraction for grants, support and incentives through environmental protection increased energy efficiency and reduction of greenhouse gas emissions,
- Increasing productivity, balancing of deterioration and renewal that balances establishment cost among other properties,
- Benefit in excess of the value of the original property.

5. Discussion and conclusion

“Materialists declare firstly that there is a definite relation between being and thought, between matter and spirit.” [29]. The sophisticated architecture and the dynamics of the real estate development sector are like “Natural System”. This expresses that the related systems have a complex network design based on the both positive and negative feedbacks in the context of self-sufficiency and self-support by assimilated renewal. All these components are seeming to take place in the sources as an important definition in order to ensure sustainability.

In view of the value of sustainable real estate development, institutional approaches are examined by academic environment and international organizations as well as international valuation organizations and asset markets. In particular, it is clear that the necessity of infrastructure and capital orientation, developed on the theoretical framework recently after 2015, is defined as a tool used by capital in order to protect the natural environment and increase economic transactions and utility. It should be reawakening and debated that the value concept against productive future approaches can be emphasized within the concept of education and ethics in a clear way. The priority of the defense should be grounded and innovative, as in the concept of capital, in which the contemporary constructivist-destructive approach is dealt with, based on the foundations of economic science.

Considering that sustainable real estate development is a productive sector, it appears that it has created new jobs-professions. The process of design that includes energy efficient, zero carbon and environmentally friendly properties; creates a system of thought, which is reflected in ergonomic phenomenon. Thus the way of ergonomic design of thoughts may become more productive. This phenomenon, which will be completed with sustainability and possible cross-info flow, is foreseen for real estate projects to be developed as “Appraisal Ergonomics”, “Valuation Process Architecture”, “Appraisal Design Architecture”, and thusly rich multi-dimensional approaches.

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