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Applying the Depreciated Replacement Cost Method When Assessing the Market Value of Public Property Lacking Comparables and Income Data

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Abstract: The growing interest in the enhancement, management, and sale of public building stock has increased the importance of their valuation and, as a result, the need to identify suitable methods for estimating value that take into account their peculiarities. They often boast architectural features (interfloor distance, layout, finishings, types of wiring/heating systems, etc.) that make them 'extraordinary' assets; in some cases, these features also endow them with monumental and/or historical importance. Thus, when valuating, it is necessary to adopt suitable methods. Where comparable examples or income-based parameters specifically concerning buildings with special features are lacking, the Depreciated Replacement Cost (DRC) method is the only system that can be used to estimate their market value. This paper aims to show how the DRC method can be applied in this specific market. The theoretical part will be coupled with a practical section where the DRC method will be used to estimate the market value of an extraordinary landmark building in Rome (Italy), the Palazzo degli Archivi di Stato (the State Archives building), in the EUR district, sold by EUR S.p.A. group (formerly known as Ente EUR) in 2015.

Keywords: appraisal; market value; depreciated replacement cost; cost approach; public real estate

1. Introduction

Over the past 20 years, the use, enhancement, and management—or alternatively, the disposal and sale—of public real estate has become a particularly significant issue in Europe [1].

Before undertaking any kind of activity and/or action affecting public buildings, it is essential that their market value be estimated. This is a necessary step in order to set up publicly accountable processes designed to identify users and/or purchasers [2].

Nevertheless, such work may well prove difficult due to the special architectural and construction features (interfloor distance, layout, finishings, types of wiring/heating systems, etc.) that characterise many public buildings and that make them, de facto, 'extraordinary'.

As often as not, these special features make them subject to specific safeguards and restrictions. In some cases, unusual architectural and construction features are combined with historical and/or monumental worth. In such cases, the restrictive measures are supported by the formal and legal requirements associated with scheduled monuments. These tend to be public architectural assets of cultural and monumental importance [3]. This kind of asset, representing an important part of the built environment, has to face the physical sustainability or the "sustainability of built environment". It should be emphasised, in fact, that in the wider perspective of the concept of "urban sustainability" (including the five dimensions of sustainability and their relationships: economic, social, ecological, physical, and political), physical sustainability, or the "sustainability of built environments", "concerns the capacity of an intervention to enhance the liveability of buildings and urban infrastructures for 'all' city dwellers, without damaging or disrupting the urban region environment. It also includes a concern for the efficiency of the built environment to support the local economy" [4].

The same assets belong to the cultural heritage, in that recognised of historical, social, and anthropological value and as enablers of sustainable development, as in the United Nations' Sustainable Development Goals (SDGs) (United Nations, 2015). The UNESCO World Heritage and Sustainable Development Programme (2016) also outlines the potential positive contributions that appropriate cultural heritage conservation and management can make to sustainable development. The theme of the enhancement of the historic, artistic, and cultural patrimony for a "human and sustainability city", is traditionally a matter of concern to the Italian appraisal and evaluation disciplines, which, already 40 years ago, starting from the formulation of the social use value, have offered a meaningful development of methodological frameworks and innovative approaches [5].

However, the special features possessed by this large proportion of public property assets make it extremely difficult to find comparables when estimating their market value. Indeed, such buildings are rarely bought and sold. Moreover, given the wide range of different architectural assets of cultural and monumental importance, the probability of finding comparable data is practically nil [6].

Even though the 'profit' of many of these properties is generated through rental/business contracts, such information may not be enough upon which to base an estimate. In many cases, these are 'surrogate' functions that differ from the property's original ends, functions usually associated with the public sector (council buildings, schools, or medical centres). In such cases, leases are established on the basis of comparables concerning similar uses that, however, do not take into account the differences that may exist due to differing special characteristics [6]. It should also be noted that such leases rarely take into account market rationales, in that local authorities often use public buildings (with special and/or monumental features) for administrative or governmental ends, for free or at a cost that is well below the market price [7].

The increasing interest among legislators in various EU member states (Germany, France, Italy, Spain, Greece, Belgium, Ireland, and the UK, pre-Brexit) regarding issues having to do with the enhancement, management, and sale of public property, pushes even more for identifying and establishing methods to estimate the market value of properties with special features, and which are, therefore, extraordinary by nature. It would be useful to apply such methods to property valuation before drafting plans to manage, maximise, or even dispose of or sell public building stock considered to be of cultural or monumental importance; though such methods could also be used to estimate the value of private property, should such buildings boast special characteristics.

Given the lack of comparables and income parameters specifically pertaining to buildings with special features, the Depreciated Replacement Cost (DRC) method becomes the only possible way of estimating the market value of such properties [8–10].

The DRC method is a form of the cost approach that is defined in the Royal Institution of Chartered Surveyors (RICS) Valuation—Global Standards 2017 (RB Global) Glossary as "the current cost of replacing an asset with its modern equivalent asset less deductions for physical deterioration and all relevant forms of obsolescence and optimization" [11]. This approach bases correspondence on the "subrogation value" indicated by the Italian school of appraisal [12,13].

As is known, the DRC method allows us to estimate the market value of a property by adding the market value of the buildable land to the cost of constructing and/or reconstructing the building, minus any depreciation. The application of the DRC method can also be justified when dealing with special buildings lacking comparables, particularly architectural assets of cultural and/or monumental importance, while the value of the buildable land—i.e., the value of building rights—has nothing to do with any of the building's features (ordinary or special). Moreover, the cost of special architectural characteristics can always be traced back to technical features/processes, so that it is usually possible to deduce data and parameters that make it possible to estimate the cost of reconstruction.

Having considered that the DRC method can also be used to value special buildings that lack comparables, the aim of this article is to establish a way of applying it to the estimation of the market value of properties with special features, and which, therefore, boast extraordinary value, in accordance with the methodology codified in the EU by the RICS [14].

The process proposed here will be structured in such a way as to be adaptable to a wide range of legislative and regulatory circumstances, particularly by local authorities responsible for managing, maximising, and, above all, selling extraordinary public buildings considered to be architectural assets of cultural and/or monumental importance.

In the method proposed here, buildable land value is estimated in accordance with the most common valuation methods codified by international standards. The innovative part concerns the estimate of the reconstruction cost, including depreciation; taking as starting point a sample of special architectural features most commonly found (in public buildings usually employed in the tertiary sector), it shows that estimating the possible impact of such features on the cost is possible and that, as a result, to assess the relationship between the cost of construction and such special features. By identifying the relationship, in terms of cost, between the ordinary and special or extraordinary features of a building, clarified using suitable correlation coefficients, it is possible to estimate the cost of reconstructing an extraordinary building using an intermediate approach, based on data regarding ordinary buildings to which corrective coefficients are applied; where necessary, it can then be depreciated in line with current international practices.

The model proposed, therefore, makes it possible to estimate the market value of a property lacking comparables and/or income data. However, the DRC method cannot calculate the marginal cost conferred by the historic and/or artistic characteristics of a monument (where present).

Given that, DRC is held to be widely applicable in any economic and administrative context characterised by: (i) high levels of standardization in the building process from which ensue homogeneous construction costs in specific territorial areas; (ii) legal frameworks which provide for private land property and granting of the right of use, which entails the display of their market value.

In this sense, the methodology here suggested, is an operational declination of the DRC method which, thus, becomes sound in general and applicable to different and heterogeneous local contexts; since the proposed methodology is applied to real estate assets, closely linked to specific economic and administrative situations, the implementation of the methodology must be carried out collecting and using data and information available on a local scale (and valid at local level), where the analysed property is located.

In order to test the operational validity of the model proposed, it was applied to a public building of particular importance, due to its role: the Palazzo degli Archivi di Stato (the State Archives building) in Rome, listed as a cultural asset as stated in the 'Code of Cultural Assets and Landscape', Article 10 of Legislative Degree no. 24/2004. It is an imposing and monumental public building, sold in 2015 by EUR S.p.A. to INAIL (the national institute for insurance against accidents at work).

Given what has been stated in this introduction, what follows is: Section 2, which analyses the materials and methods used as benchmarks when developing this research, and which particularly provides a summarised context analysis regarding strategies for managing public building stock and valuation tools; Section 3, which sets out a possible approach to applying the DRC method; Section 4, where the procedure is applied to estimate the value of the State Archives building; and Section 5, which sets out the conclusions of this research.

2. Context Analysis: Strategies for Managing Public Building Stock and Valuation Tools

2.1. The Management of Public Building Stock in Europe over the Past Two Decades

During the past two decades, many European countries have set up policies to enhance or sell their property assets. These policies were created to rationalise the number of properties that were only partly used so as to alleviate national public debt, mainly from the profit earned through their sale, and adjust the balance between public debt and GDP to new European budget regulations [15].

In particular, the rate at which public properties were sold grew consistently up until the global financial crisis of 2008: from approximately €3 billion in the 2003–2005 period to approximately €13 billion in the subsequent 2006–2007 period. After 2008, following the downturn of the property market, the sale of public buildings slowed down slightly, due, amongst other things, to an unwillingness amongst many governments to undersell public property once prices in general fell. Nevertheless, in 2011 even this market sector showed signs of recovery, with sales of public buildings worth €2.3 billion [16]. In the years that followed, the process of maximising public building stock continued in Europe. Many countries approved plans to develop and sell buildings and land owned both by central government and by local authorities. However, an analysis of the strategies adopted by European countries highlights how, in recent years, such policies differ with regard to the planning of sales, as well as with regard to procedures for identifying and maximising building stock.

In 2005, Germany's central government decided to unite the offices managing the building stock of its Länder, creating a central federal agency: the Bundesanstalt für Immobilienaufgaben (or BImA). The BImA manages a total of approximately 500,000 hectares of surface area and 39,000 buildings [17] and not only manages property assets, but also establishes and implements a strategy for selling properties that do not provide a high level of income or that are now deemed superfluous. The properties sold off are mostly former military premises turned into residential or recreational buildings thanks to town planning conversion projects, as well as into forests and homes. The fact that approximately 20% of total European property sales in 2011 were conducted on German soil is proof of the BImA's success.

In France, the Service France Domaine was set up in 2007. This agency reports to the Direction Générale des Finances Publiques. Service France Domaine is responsible for managing state-owned properties and drafting long-term plans for their redevelopment and sale. The French government has estimated that the sale of public property assets has amounted to a total value of €2 billion from 2006 to 2011. A sales plan for the 2012–2014 period was later formulated which concerned 6% of public assets, the equivalent of approximately 2000 buildings. The properties selected for sale, following repair and rationalisation work, mostly belong to the Ministry of Defence, offices, lighthouses, and forest shelters [18].

In the UK, prior to Brexit, the total value of properties owned by central government and local authorities amounted to £370 billion [19,20]. The government adopted a policy mainly based on the rationalisation of its assets through the improved efficiency of property management, combined with the sale of a smaller proportion of surplus assets. To this end, the British government set up the Government Property Unit (GPU) in 2010 in order to "reduce the number of properties (known as rationalisation) in the central civil estate and to deliver maximum savings," using a complex centrally coordinated system. In its Government Estate Strategy policy paper [21], the GPU plans to place unused properties listed in the Register of Surplus Public Sector Land on the market.

In 2013, the Spanish central government approved the 'Programa para la puesta en valor de los activos inmobiliaros del estado', which concerns over 15,000 public buildings. According to this programme, the Ministerio de Hacienda y Administraciones Públicas [22], particularly the Dirección General de Patrimonio de Estado, aims to optimise the use of public buildings, maximising its assets, and increase the number of sales in order to contribute to state coffers. Independent regions, particularly Catalonia and Andalusia, have also arranged to sell a number of properties.

In 2011, Greece created the Hellenic Republic Asset Development Fund S.A., or HRADF, whose only aim is to maximise the country's income from the redevelopment and sale of public property assets. The sales plan drafted by the government concerns 70,000 public assets with a total value of approximately €25 billion [23]. The properties selected for sale vary enormously: estates earmarked for development in tourist areas, hotel chains requiring renovation, historic buildings located abroad, as well as 28 public buildings, including the headquarters of the Ministry of Culture, the Hellenic Statistical Authority, and the Greek Home Office's main building, sold using a leaseback system [24]. The Greek government has also decided to incentivise and facilitate these sales by creating a portal on the HRADF's website—http://www.hradf.com/en—where visitors can view detailed information and documents regarding the properties for sale.

In Belgium, the 2001–2006 plan for selling public assets was vehemently opposed. The office responsible for managing and selling public buildings is currently the Administration Services Patrimoniaux, a wing of the Service Public Federal Finances. The properties earmarked for sale tend to be those listed as superfluous and unused by the authorities; the actual sale is then completed by one of a number of *comités d'acquisition* [25].

In Ireland, a 2014–2016 Public Service Reform Plan was drafted [26], where the specific aim of reducing the costs of managing public property was identified in the Property Asset Management section. Though mainly focusing on the issue of efficiently managing public services, the plan also lists the sale "of surplus state-owned assets" as a way of reducing costs.

The issue of renovating and maximising public assets has also become a high-profile concern in Italy over the past 20 years, during which a succession of legal measures have been drafted. Article 58 of legislative decree no. 112 of 2008 and Article 33 bis of legislative decree D.L. 201 of 2011 are particularly important, as they basically state that in order to renovate, manage, or maximise the public property owned by regional governments, provincial governments, town councils, or other local organisations, each organisation can make a list of the single properties found within its catchment area that are not needed to carry out its institutional functions and that can be maximised, or sold, and can draft a plan for selling and maximising such properties, attaching such a plan to its budget, with the support of the Agenzia del Demanio state property office, if it so wishes, to create special-purpose entities/companies/consortiums [27,28].

2.2. Valuation Methods Supporting the Management of Public Property Assets

The push to manage, maximise, use, or sell public property assets has led to a greater need for valuation procedures, particularly those linked to the estimation of the market value of such properties.

In the EU, valuation methods that take into account the specific characteristics of the building that requires valuation have been codified in documents regarding international and European valuation standards (IVS; EVS) [29–31], adopted as benchmarks by most international publications, including the Red Book published by the Royal Institution of Chartered Surveyors (RICS) [32].

In the IVS, the tangible features of properties, whether ordinary or extraordinary, combined with aspects associated with 'productive' features (limits to property rights), have an impact on a building's market value, and should, therefore, be taken into account when estimating 'fair value' (cfr. Chapter 4: RICS Valuation—Professional Standard, Red Book).

The IVS identify three principal approaches to valuation that are generally recognised at an international level: (a) the market approach; (b) the income approach; and (c) the cost approach.

These approaches may all be used to formulate a valuation using whatever basis of value is applicable. In short, the market approach can be used where there is an active sales market; the income approach can be used where there is an active rental market; and the cost approach can be used where comparable data is unavailable.

In fact, according to the RICS, the cost approach/DRC method is adopted where there is no active market for the asset being valued—that is, where there is no useful or relevant evidence of recent sales transactions due to the specialised nature of the asset—and it is impractical to produce a reliable valuation using other methods [14].

The DRC method may be used for the valuation of specialised property, which is defined in the RB Global Glossary as: "A property that is rarely, if ever, sold in the market except by way of a sale of the business or entity of which it is part, due to the uniqueness arising from its specialised nature and design, its configuration, size, location or otherwise." This definition is broad and can apply to properties or assets that may be of conventional construction, but become specialised by virtue of being of a size or in a location where there is no relevant or reliable evidence of sales involving similar properties.

As previously illustrated in Section 1, this is the case when it comes to many public properties that boast 'special' features, making them, de facto, 'extraordinary'. That is why the implementation of the sales comparison approach to calculate their (market) value proves to be a complicated process due to the lack of comparable data upon which such an estimate can be based. Applying the income approach to this kind of building can also prove difficult, if not impossible, if there are no income data available.

In the light of increasing interest amongst legislators in the sale of public buildings, given the particular nature of a vast swathe of public building stock in the countries examined in Section 2.1 above, it becomes essential to establish suitable valuation procedures that could be adopted before drafting plans to manage, maximise, or sell public buildings of an extraordinary nature, despite the lack of comparables or income data.

The RICS's "Depreciated replacement cost method of valuation for financial reporting" manual clarifies the methodological approach that should be adopted when applying the DRC method [14]. However, this benchmark document of international scope does not provide details on how to apply this method.

The analysis carried out on the application methodologies of DRC showed that there is strong potential for implementing this procedure in real estate evaluation [33–38] and in facility management [39–43]; in the first field, DRC may be used, as already argued, when comparables are missing and when other estimation procedures cannot be used. In facility management, DRC makes it possible to evaluate the convenience of a maintenance program, which is a function of the market value of the building, which, in turn, depends on factors that affect the urban rent [42]. The present research work falls within the scope of the studies relating to real estate valuation; to date (2020), Scopus and Web of Science databases store a rather limited number of articles on this subject, and predominantly theoretical rather than operational in their approach [33–43]; this state of the art is the ground for the methodological-operational study proposed in this article.

As mentioned in Section 1, when discussing how the DRC method works, it is possible to estimate the 'building land value' element using procedures that have already been codified in a wide range of field publications regarding valuation. In contrast, in order to estimate the 'building value (minus any devaluation)' element, the cost of construction can be estimated, according to a number of field publications, using direct, indirect, or intermediate procedures [9,39,44]. In line with the methodology codified by the RICS, the DRC method can be used in all three of these procedures [14]; however, what follows must be kept in mind.

The direct procedure can run into the same difficulties as experienced when attempting direct market value estimates: the extraordinary nature of the property requiring estimation may make it impossible to find comparables as regards the cost of construction [45,46].

The indirect procedure, based on the sum of all construction work and its overall price seems generally difficult to implement on extraordinary buildings with special architectural and/or technological features. Problems arise when put into practice, both when making comparisons and when itemising cost estimates in detail, making the margin of error so large as to entirely invalidate the estimate [47].

When adopting the intermediate procedure, which takes its cue from the 'basic' cost of reconstructing an ordinary building, the differences between the 'basic' building and the building requiring estimation (with special characteristics, in this case) must be identified and, consequently, the increase in costs due to architectural and/or technological elements that can be considered 'special'. Although it has to be conceded that it is difficult to estimate the difference in cost between a special element and an ordinary one, it seems reasonable—given the field literature available and the growing support provided by IT in the form of tools such as Building Information Modelling (BIM) [42,48,49]—to attempt to formulate cost trends that depend on the form a construction element may have, even when it is extraordinary or special in nature. As far as this aspect is concerned, the practical model put forward here provides initial variations in terms of percentages of costs when an element develops from a condition of 'ordinariness' to that of 'extraordinariness', applicable to all the various construction elements found in a building, making it possible to estimate the 'construction value' element through the process of estimating the intermediate cost.

Section 3 below presents the procedure recommended here, step by step.

3. Applying the Cost Approach when Estimating the Market Value of Properties with Special Features

The DRC method makes it possible to estimate the market value (hereinafter MV) of a property by adding the market value of the land to the cost of reconstructing (hereinafter CV) the building, minus any depreciation that may have accumulated at the time of the valuation. Generally speaking, it can be exemplified by the following Formula (1):

$$MV = MV_{land} + CV_{dep} \tag{1}$$

The MV_{land} estimate is included in traditional buildable land valuation methods (Transformation Value Method).

In certain cases, there may be provisions in urban-planning instruments, or statutory or regulatory options, that make possible a 'heavy' transformation of a building, involving a change in its designated use, or even demolition of the building and reconstruction in a different form, once again with a change in its designated use, as well as a different conformation in terms of type and function. Estimates of the value of the building, when considered as the underlying asset of a real-estate optimisation initiative that results in a new property (either through heavy restructuring or by demolition followed by reconstruction) must be based, in such instances, solely on the highest-value and best-use approach. The resulting estimate restores the MV of the building with respect to the effective possibility of its transformation. As is readily apparent, public real estate with special features rarely qualifies for such treatment, due to the presence of restrictions and constraints that, as a rule, do not permit 'heavy' interventions on buildings.

In order to estimate the CV_{dep}, one can either adopt a direct or indirect approach. However, the indirect approach, which is carried out by drafting a bill of quantities, can prove difficult due to the complexity of this procedure and may not be possible at all should the special features be the product of unusual construction methods that do not appear on pricelists, thus, making it difficult to formulate new prices.

When it comes to buildings with special features, valuers must take care when estimating the CV_{dep} parameter. The operational procedure proposed below (see Section 3.2) suggests an innovation to the traditional DRC method that involves adding a step to the valuation of the CV_{dep} through an 'intermediate' way: i.e., detailing a direct approach using a sales comparison estimate of the cost of reconstruction by applying corrective coefficients that can highlight the differences between an ordinary property whose cost of reconstruction is known and the property with special features that requires valuation. Should a building boasts features of monumental, historic, artistic, and/or architectural value, a further element can be added to the parameters mentioned above. Estimating such an element is undoubtedly complicated given the extremely variable nature of the concept of monumental, historic, artistic, and/or architectural value, and the importance of such qualities in properties, so it will not be taken into account below [50–53].

So let us move on to establish the methods for estimating the elements that form the DRC method when calculating the value of buildings with special features.

3.1. Estimating MV_{land}

The market value of buildable land can be estimated in two ways:

(i) using a direct method, if information (known prices of comparable size) regarding similar properties is available (same type of area, similar Floor Area Ratio and purpose, a similar legislative/administrative context) using the following Formula (2) [12];

$$MV_{land} = \text{unit comparable price} * \text{size} \quad (2)$$

(ii) using an indirect method with the Transformation Value Method (TVM), which can be implemented using the following Formula (3) [54]:

$$MV_{land} = \frac{MV_{bl} - \Sigma K_p}{(1 + r')^n} \quad (3)$$

where: MV_{bl} = is the market value of all properties that have been constructed and will be sold, added together; ΣK_p = is the total construction cost; r' = is the capitalisation rate of the property transaction; n = is the number of years required to complete the property transaction.

3.2. Estimating CV_{dep}

The cost of reconstructing an existing building erected in the past is calculated by adding together all the costs that a construction company would have to pay at the time of the estimate in order to complete an identical or equivalent building during a hypothetical construction process, linked to market production costs and a particular timescale. In other words, the cost of reconstruction is the cost of constructing an existing building from scratch.

The cost of reconstruction includes the physical cost of reconstructing the building and the other costs that are payable to complete it. To be more precise, the main items included in the cost of reconstruction in the traditional system of organising such projects are the following:

- the physical cost of reconstruction, which in turn includes:(1) the sum of labour costs, rental costs, materials, and transportation; (2) general costs; (3) profit (of the construction company);
- bureaucratic/administrative fees;
- legal fees for reconstruction/construction (planning permission/town planning), if required; financial costs;
- profit (of the company overseeing the reconstruction project).

When calculating the cost of reconstruction, it may prove necessary to take into account the cost of demolishing, recycling, and/or removing the rubble of the existing building, depending on the particular circumstances of each case and the reasons that led to its reconstruction.

The depreciation of the cost of reconstruction is calculated by taking into account, either directly or indirectly, the age of the building compared to its life expectancy.

In order to estimate CV_{dep}, what is proposed here is a direct approach plus the application of corrective coefficients that compensate for the differences between the assets considered comparable and the building that requires valuation. Special architectural features often make it impossible to find entirely similar buildings where recent prices are known for construction or reconstruction. It is, therefore, impossible to estimate the cost of reconstructing a building by comprehensively comparing it to assets considered comparable with known, comparable prices.

Thus, the valuation must be carried out using the procedure explained below.

3.2.1. Identifying an Overall Benchmark Estimate Value ($CVtu_{ref}$)

The first step towards estimating the CV_{dep} involves identifying a similar range of recently constructed buildings (that can be considered comparable) whose construction costs are known; information concerning the physical cost of constructing such buildings must be reworked in order to establish one single estimate figure, based on the average features found in the sample range of buildings, which will become the overall benchmark figure (which is the physical cost) for estimating the overall benchmark estimate value ($CVtu_{ref}$) [55,56] to which corrective coefficients are subsequently applied in line with what is detailed in Section 2 below. Given that buildings with special features are often made up of sections that differ within the same building, one should hazard an estimate by considering the various different parts that make up each building. The following in particular can be taken into account:

- primary areas: serving the building's main purpose;
- secondary areas: supplementary functions found in lower ground floors or mezzanines;
- the external area, grouped into the following categories: (a) extensions: open spaces within a building (porticoes, balconies, cloisters); (b) appurtenances: open spaces outside a building (courtyards, forecourts, parking spaces).

3.2.2. Identifying an Overall Figure Relating Specifically to the Building Requiring a Valuation (CVtu)

In order to compensate for the differences between the sample range of buildings considered to be comparable enough (due to specific morphological or technological characteristics, etc.) to extrapolate a $CVtu_{ref}$ and the building requiring valuation (which could possess features that differ from those found in the comparable sample), and in order to ensure that the overall benchmark valuation figure is consistent with the specific characteristics (the special features) of the building requiring valuation, it is necessary to apply corrective coefficients to the abovementioned overall benchmark $CVtu_{ref}$ value. The purpose of corrective coefficients is to improve the consistency between the sample of buildings considered to be comparable and the building requiring valuation in order to come up with the best estimate. Before applying corrective coefficients, the various different parts that make up the building with special features requiring valuation should first be analysed. The differences between the average characteristics of the sample range of buildings considered to be comparable and the building with special features requiring valuation will determine which corrective coefficients will be suitable. Thus, corrective coefficients must be applied to the building requiring valuation part by part and not as a whole (considering each type of building area), on the basis of the parts listed in Section 1. By applying corrective coefficients to the overall benchmark $CVtu_{ref}$ value, one may then establish the most probable CVtu physical cost of construction for each part of the building requiring valuation. As ceiling height is also considered a special feature that confers extraordinary importance, it is necessary to apply a ceiling height multiplier (of the estimated figure) from amongst the various different corrective coefficients.

The logic behind the procedure explained above is also supported by the work of statistical institutes (e.g., like ISTAT, Italy's national institute of statistics), which calculates national trends in construction costs as a single parameter throughout the country, though specifying that, when estimating a particular construction project, variables regarding both infrastructural accessibility and type should be taken into account.

In this specific case, according to field literature [57], the variables influencing corrective coefficients (k_n) are the following:

- Infrastructural accessibility (k_{site}). As well as all the other variables, both morphological and technological, determining the specific nature of a building, the reconstruction cost is also enormously influenced by the infrastructural accessibility of the construction project and the way the construction site will be organised and managed, given that special features (such as particularly tall buildings) require unusual working methods that increase costs;

- Morphology (k_{morph}). The complexity of a building's layout can affect its construction cost. Buildings with special features may not follow simple geometric patterns and may feature a complex arrangement of rooms. This factor has a significant impact on the cost of reconstructing a building;
- Structure (k_{stru}). The span between columns, the number of storeys, the type of terrain, and, as a result, the type of foundations, all affect the construction cost. For example, as far back as 1978, Forte and De Rossi highlighted how the increase in span from 4 to 7 metres between columns approximately doubled the cost of a building's structure (in reinforced concrete), and that an increase in the number of floors had an effect on construction costs that was not proportional; the same could be said for a building's foundations, which are designed and constructed on a case-by-case basis according to the load-bearing characteristics of the land upon which a building is constructed;
- Interior and exterior finishings (k_{fin}). This factor significantly influences the cost of constructing a building. While the level of a building's finishings cannot be lowered beyond a specific minimum standard that would otherwise affect its performance, it can however be heightened to a point that can be hard to quantify. Nevertheless, it is usually possible to identify a range of finishings (both interior and exterior) that are recognised as either 'inexpensive' or 'luxury';
- Systems (k_{imp}). The impact on the cost of construction of the wiring and/or heating systems chosen depends on the type of systems found in the building requiring valuation compared to its comparables: in contrast with other variables, regulations that increasingly insist on high standards mean that the impact of this factor creates increases or decreases that have a minor effect on the valuation figure;
- Interior and exterior windows and doors (k_{wind}). The impact of windows and doors depends on the type of building and the type of architectural solutions adopted in the building, particularly the proportion of wall-to-window space along the facade and the quality of those windows and doors;
- Ceiling height multiplier (K_{hm}). Every linear metre of extra ceiling height compared to the standard Surface to Volume Ratio of 3.2 lm increases the construction cost by 18%. Thus, once the overall figure for constructing each building has been estimated (which assumes a Surface to Volume Ratio of 3.2 m), it is necessary to multiply that figure by the ceiling height multiplier in order to establish the physical cost of construction.

Corrective coefficients are, therefore, assigned depending on the differences (in infrastructural accessibility, structural and morphological variables, finishings, systems, windows and doors, and ceiling heights) between the building or buildings considered to be comparable and the building requiring valuation. These coefficients represent, in percentages, the variation in the cost of reconstructing the building requiring valuation compared to the cost of constructing the comparables due to the differences listed above, as specified in Table 1.

The corrective coefficients (k_n), as listed in Table 1, below, thus represent the maximum increase or decrease that each variable produces on the Cost of Construction in an ordinary average sample building (or buildings). These parameters are not set in stone. They can be obtained on the basis of an analysis of data regarding the cost of buildings, suitably reworked in order to identify the relationship between the cost of various elements involved in the construction of different types of buildings, comparing the costs of the extra ordinary building components with those of the same but ordinary building components. The formula to calculate k_n is the following (4):

$$k_n = \frac{CVeoc(n)_1 + CVeoc(n)_2 + \ldots + CVeoc(n)_n}{CVoc(n)_1 + CVoc(n)_2 + CVoc(n)_n} - 1 \quad (4)$$

where:

CVeoc(n) = is the Cost Value of extraordinary "n" constructive component;
CVeoc(n) = is the Cost Value of ordinary "n" constructive component.

Table 1. Corrective coefficients for estimating CVtu.

Correction Criteria	Criteria for Allocating the Corrective Coefficient		% Difference in the Cost of Reconstruction $CVtu_{ref}$
Infrastructural accessibility	Access to the construction site	Assessing the position of the construction site compared to a comparable building (greater or lesser accessibility)	k_{site}
	Logistics	Assessing any logistical constraints (climate, altitude, terrain, accessibility of the construction site, limited working hours, the impossibility of using particular equipment, the use of extraordinary equipment etc.) compared to a comparable building	
	Planning restrictions	The need for additional authorisation compared to what is ordinarily required when constructing a building	
Morphology	Layout	Assessing the layout compared to a comparable building (greater or lesser complexity)	k_{morph}
Structure	Span between columns	Assessing the difference in span between load-bearing columns	k_{stru}
	Number of floors	Assessing the difference in height between the building and a comparable building	
	Foundations	Assessing the structure of the foundations compared to a comparable building	
Finishings	Flooring	Assessing the quality of the flooring compared to a comparable building	k_{fin}
	Interior finishings	Assessing the quality of the building's interior finishings compared to a comparable building	
	Exterior finishings	Assessing the quality of the building's exterior finishings compared to a comparable building	
Systems	Wiring	Assessing the building's wiring (type, legal standard) compared to a comparable building	k_{imp}
	Plumbing and heating	Assessing the building's plumbing and heating systems (type, legal standard) compared to a comparable building	
	Mechanical systems	Assessing the building's mechanical systems (lifts, stairlifts, other) compared to a comparable building	
	Air conditioning	Assessing the building's air conditioning system compared to a comparable building	
	Fire prevention	Assessing the building's fire prevention systems compared to a comparable building	
	Other (TV, telephone, various types of cables)	Assessing the building's other systems (if present) compared to a comparable building	
Windows and doors	Interior	Assessing the quality of the building's indoor windows and doors compared to a comparable building	k_{win}
	Exterior	Assessing the quality of the building's exterior windows and doors compared to a comparable building	
Corrective criteria	**Method for assigning corrective coefficients**		**% increase per each linear meter of average room height compared to comparable interfloor heights**
Ceiling height multiplier	Assessing the difference in ceiling height compared to a comparable building		K_{hm}

This same procedure applies when estimating the impact of the height of the rooms, which is considered, in the present case, to be one of the "n" construction components identified.

They also can be deduced from experience gained, e.g., when applying the SISCO method [58]; more detailed coefficients can be obtained from Building Information Modelling systems (BIM) [42,48,49].

When estimating the CVtu, after having calculated the various corrective coefficients (k_n), the above requires the application of the following Formula (5):

$$CVtu = [CVtu_{rif} * (1 + k_{site} + k_{morph} + k_{stru} + k_{fin} + k_{imp} + k_{wind})] * (1 + K_{hm}) \quad (5)$$

The total corrective coefficient is therefore the difference in terms of increased or decreased costs between a building (or buildings) whose $CVtu_{ref}$ has been calculated and the building with special features requiring valuation.

3.2.3. The Depreciation (k_{dep}) of the Specific Overall Value of the Building Requiring Valuation ($CVtu_{dep}$)

Having calculated the total physical cost of reconstructing a building with special features, it is then necessary to apply the depreciation coefficient, taking into account, as mentioned earlier, the building's remaining lifespan in order to estimate the overall depreciated physical $CVtu_{dep}$ cost; the percentage of depreciation, therefore, corresponds to the percentage of its 'operational state' compared to its life expectancy. The k_{dep} depreciation coefficient can either apply to the entire building or refer to specific parts or elements. In this particular methodological proposal, an average is calculated from the sum of depreciation coefficients deduced from: a) the comparison between LCs_{buil} that indicates the life lived by the building's structural parts and the LEs_{buil} that indicates the total life expectancy of the building's structural parts, considering that they account for 30% of the cost of the entire building; b) the comparison between $LCop_{buil}$ that indicates life already lived by the other parts of the buildings and the $LEop_{buil}$ that indicates the total life expectancy of the other parts of the building, considering that they account for 70% of the cost of the entire building. The breakdown is assumed to correspond to the most widely used manuals of operational estimation, which assign to the structural parts of a building, with respect to its overall construction costs, a generic impact of between 25% and 35% [12]. The formula is the following (6):

$$k_{dep} = [(LCs_{buil}/LEs_{buil}) * 0.3] + [(LCop_{buil} / LEop_{buil}) * 0.7] \quad (6)$$

3.2.4. The Depreciated Cost of Reconstruction (CV_{dep})

Having established the overall physical depreciated cost of reconstruction, it is then possible to estimate the physical cost of reconstructing the entire building, multiplying each figure by the single figure estimated for each part of the building. The total amount will be the total depreciated physical cost of reconstruction CV_{dep}. Nevertheless, in order to calculate the cost of construction, it is necessary to take into account the sum of the following: the physical cost of construction, bureaucratic fees, any legal costs payable for constructing or reconstructing a building (depending on applicable legislation), financial costs, and the profit of the company overseeing the reconstruction.

Below is a diagram summarizing the proposed methodology (Table 2):

Table 2. Summary of phases of the model proposed, relations between methodology and case study.

	Phase	Result	Methodology	Case Study
MV	**MV_{land} + CV_{dep}**	**MV**	Section 3	**Sec. 4 point c**
1	**Estimating MV_{land}**	**MV_{land}**	Section 3.1	**Sec. 4 point a**
1.a	Direct or indirect method (TVM)	MV of land without building, only considering its building right	Section 3.1	Table 4
2	**Estimating CV_{dep}**	**CV_{dep}**	Section 3.2	**Sec. 4 point b**
2.a	Identifying an overall benchmark estimate value	$CVtu_{ref}$	Section 3.2.1	Table 5
2.b	Identifying an overall figure relating specifically to the building requiring a valuation	CVtu	Section 3.2.2	Tables 6 and 7
2.c	The depreciation (kdep) of the specific overall value of the building requiring valuation	$CVtu_{dep}$	Section 3.2.3	Table 8
2.d	d) The depreciated cost of reconstruction	CV_{dep}	Section 3.2.4	Table 9

4. The Case Study: Estimating the Market Value of Four Assets Sold by EUR S.p.A. to INAIL in December 2015

EUR S.p.A. (90% owned by the Italian Ministry of Economics and Finance and 10% owned by Roma Capitale town council) is a property management and development company, founded in 2000 by what was known as the Treasury, at that time, and converted from the Ente Autonomo Esposizione Universale di Roma world's fair organisation.

It owns particularly valuable assets that are extraordinary due to the sheer number of grand architectural landmarks produced by rationalist movement, unique both in terms of their size and quality. EUR S.p.A.'s property assets also include 70 hectares of parks and gardens that are open to the public and considered to be an extraordinary reserve of biodiversity.

EUR S.p.A.'s mission is to manage and enhance its assets in order to maximise their profitability whilst respecting their artistic and historical importance, working with Roma Capitale's heritage department and the Lazio region's office for cultural heritage and landscape. In light of this, EUR S.p.A. activity falls within Public Administration/Companies powers for the enhancement of the urbanized area and real estate assets to which more and more strategic policies have been directed in recent times [59,60].

In keeping with its social purpose and with what is stated in its charter, EUR S.p.A. carries out conservation work safeguarding its historic, artistic, and landscape heritage, renting out renovated premises through its property management department. In contrast, its asset management activities involve the implementation of property development projects and urban improvements.

In the early 2000s, EUR S.p.A. launched its new La Nuvola conference centre project. The cost of completing the project (which is yet to be established, due to reservations raised by the construction company)—approximately €350 million—led to a considerable level of debt, which EUR S.p.A.'s management decided to address by selling four building complexes to INAIL (the national institute for insurance against accidents at work): (i) Palazzo degli Archivi di Stato (the State Archives building); (ii) Palazzo delle Arti e Tradizioni Popolari; (iii) Palazzo della Scienza Universale; and (iv) Palazzo della Polizia Scientifica.

The sale of these buildings to INAIL was worth approximately €297.5 million for roughly 92,000 sqm of primary gross floor area and roughly 46,500 sqm of secondary gross floor area. Taking into account the secondary gross floor area with a correlation coefficient of 25%, whilst ignoring the external areas, appurtenances and extensions, the total commercial surface area amounts to approximately 103,000 sqm, from which one can infer a price of roughly €2900 per commercial square metre.

The procedure proposed in Section 3 is applied, below, to estimating the market value of the State Archives building. The DRC method has been adopted here because the special characteristics of this asset make it impossible to find comparable data that could allow direct procedures; moreover, many of its rooms have 'governmental' functions, so that rental fees, wherever applied, are in line with those commonly practised in a spirit of inter-institutional cooperation, and do not obey market forces.

The figures concerning the proportions of the State Archives building, which made it possible to apply the DRC method, were gleaned from publications regarding EUR S.p.A.'s assets (Table 3).

Table 3. The Palazzo degli Archivi di Stato building's proportions.

Palazzo Degli Archivi di Stato Building Proportions				
ID	**Gross Floor Area**	**Purpose**	**Size**	
A.1	Primary	Storage rooms, offices, conference rooms, archives, apartments	sqm	33,729
A.2	Secondary	Walkways, lofts, storage rooms, archives, cavity wall space, store rooms, utility rooms	sqm	20,697
A.3a	Exterior: extensions	Porticoes *	sqm	14,815
A.3b	Exterior: extensions	Cloisters *	sqm	2700
A.4	Commercial	Shops	sqm	1171
A.5	Exterior: appurtenances	Park	sqm	2552
As	Total	(A.1 + A.2 + A.3a + A.3b + A.4 + A.5)	sqm	75,664
Av	Total (volume)		cm	299,400

* Approximate unverified data.

The MV_{land} and the CV_{dep} was then estimated.

4.1. MV_{land} of the Case Study

The MV_{land} was estimated using the method proposed here, by adopting the direct methodology. Data from 2015 provided a market value of buildable land in the EUR district of approximately €950 per sqm of possible gross floor area. Given that secondary areas and porticoes can be constructed without being counted in Floor Area Ratios, if the building is considered to be 34,900 sqm in size (primary and commercial areas), the result is an MV_{land} rounded up to €33,155,000 (Table 4).

Table 4. The estimated MV_{land} of the Palazzo degli Archivi di Stato building.

Estimating MV_{land}	
Unit price (comparable)	€950/sqm of possible gross floor area
Size (building rights)	34,900 sqm of gross floor area
MV_{land}	unit comparable price * size €950/sqm * 34,900 sqm = €33,155,000 (rounded)

4.2. CV_{dep} of the Case Study

Next the CV_{dep} was estimated, in keeping with Section 1 of this method, which involved the selection of a sample range of known prices, inferred from publications detailing EUR S.p.A.'s assets, regarding the construction of buildings (Building.n, acronym B.n) that make it possible to infer the basic single figure ($CVtu_{rif}$) for the valuation (Table 5).

Table 5. The estimated $CVtu_{rif}$ of each area of the Palazzo degli Archivi di Stato building.

Overall Benchmark Estimate Value Inferred from Comparables			
Primary and Commercial Area			
B.1.1	Single estimated figure of value (2015 data)	€/sqm	1390
Secondary area			
B.1.2	Single estimated figure of value (2015 data)	€/sqm	1080
Porticoes			
B.2	Single estimated figure of value (2015 data)	€/sqm	680
Outdoor spaces			
Cea	Single estimated figure of value (paving and furnishings, driveways, car parks, primary green space)	€/sqm	61

Having inferred the basic single value of each portion of the building, the corrective coefficients were then applied (see step 2 of this proposed method for estimating CV_{dep}); the corrective coefficients were inferred from EUR S.p.A. records, and in particular from documents pertaining to the company's in-house valuation of its assets (Table 6).

Table 6. Corrective coefficients (preparatory for estimating CVtu).

Corrective Coefficients (Preparatory for Estimating CVtu)					
(a) Primary Area					
The Application of Corrective Coefficients					
		Primary Areas	**Secondary Areas**	**Porticoes**	**Comm. Areas**
Elements	**Indicators**	**Corr. Coeff. (%)**	**Corr. Coeff. (%)**	**Corr. Coeff. (%)**	**Corr. Coeff. (%)**
Infrastruc. accessibility	Access to construction site	1.50%	1.50%	1.50%	1.50%
	Logistics	0.00%	0.00%	0.00%	0.00%
	Planning restrictions	15.00%	15.00%	15.00%	15.00%
Morphology	Layout	0.00%	0.00%	0.00%	0.00%
Structure	Span between columns	3.00%	3.00%	3.00%	0.00%
	Number of floors	2.00%	2.00%	2.00%	0.00%
	Foundations	0.00%	0.00%	0.00%	0.00%
Finishings	Flooring	0.00%	−2.50%	1.00%	0.00%
	Interior finishings	0.50%	−2.50%	-	0.50%
	Exterior finishings	4.00%	−2.00%	4.00%	4.00%
Systems	Wiring	0.00%	0.00%	-	0.00%
	Plumbing/heating	0.00%	0.00%	-	2.00%
	Mechanical systems	0.00%	0.00%	-	−0.30%
	Air conditioning	3.50%	0.00%	-	6.00%
	Fire prevention	1.50%	1.50%	-	1.50%
	Other (TV, telephone, other cables)	0.70%	0.00%	-	0.70%
Windows and doors	Interior	0.00%	0.00%	-	0.00%
	Exterior	0.00%	0.00%	-	0.00%
C.1a	Overall corrective coefficient	31.20%	16.70%	26.50%	30.90%
C.2a	Ceiling height multiplier (average h)	54.00% (6.50 m)	45.00% (6.00 m)	54.00% (6.50 m)	54.00% (6.50 m)

The CVtu of reconstructing the property was then estimated (Table 7). It is not necessary to apply corrective coefficients when estimating the Cea, which refers to outdoor spaces.

Table 7. Estimated CVtu.

Estimate of CVtu				
Primary Area (a)				
B.1.1	Overall estimated value inferred from comparables	From Table 5	€/sqm	1390
C.1.a	Comprehensive corrective coefficient	Source: EUR S.p.A.	%	31.20%
	Overall estimated value Surface to Volume Ratio 3.2 lm	B.1.1 * C.1.a	€/sqm	1824
C.2.a	Ceiling height multiplier	Source: EUR S.p.A	%	54%
CVtu.a	Overall physical cost of reconstruction	B.1a * C.2.a	€/sqm	2808
Secondary areas (b)				
B.1.2	Overall estimated value inferred from comparables	From Table 5	€/sqm	1080
C.1.b	Comprehensive corrective coefficient	Source: EUR S.p.A.	%	16.70%
	Overall estimated value Surface to Volume Ratio 3.2 lm	B.1.2 * C.1.b	€/sqm	1260
C.2.b	Ceiling height multiplier	Source: EUR S.p.A.	%	45%
CVtu.b	Overall physical cost of reconstruction	B.1b * C.2.b	€/sqm	1828
Porticoes (c)				
B.2	Overall estimated value inferred from comparables	From Table 5	€/sqm	680
C.1.c	Comprehensive corrective coefficient	Source: EUR S.p.A.	%	26.50%
	Overall estimated value Surface to Volume Ratio 3.2 lm	B.2 * C.1.c	€/sqm	860
C.2.c	Ceiling height multiplier	Source: EUR S.p.A.	%	54%
CVtu.c	Overall physical cost of reconstruction	B.1c * C.2.c	€/sqm	1325
Commercial area (d)				
B.1.1	Overall estimated value inferred from comparables	From Table 5	€/sqm	1390
C.1.d	Comprehensive corrective coefficient	Source: EUR S.p.A.	%	30.90%
	Overall estimated value Surface to Volume Ratio 3.2 lm	B.1.1 * C.1.d	€/sqm	1820
C.2.d	Ceiling height multiplier	Source: EUR S.p.A.	%	54%
CVtu.d	Overall physical cost of reconstruction	B.1d * C.2.d	€/sqm	2802

In order to apply the depreciation coefficient (step 3 of the proposed method for estimating CV_{dep}) based on EUR S.p.A. records, it was inferred that the building complex was in excellent condition from a structural point of view. As far as other construction elements were concerned, it was calculated that the building was in good condition, as it still possessed 75% of its life expectancy. The $CVtu_{dep}$ was then estimated on the basis of these coefficients.

$$k_{dep} = [(1\ /1) \times 1/3] + [(0.75\ \ /1\ ) \times 2/3]\ =\ 0.84$$

The $CVtu_{dep}$ can then finally be estimated (Table 8).

Table 8. Estimated CVtudep.

$CVtu_{dep}$ Estimated (in Round Numbers)		
Primary area		
CVtu.a	€/sqm	2808
$CVtu_{dep}$.a	€/sqm	2360
Secondary area		
CVtu.b	€/sqm	1828
$CVtu_{dep}$.b	€/sqm	1530
Porticoes		
CVtu.c	€/sqm	1325
$CVtu_{dep}$.c	€/sqm	1110
Commercial areas		
CVtu.d	€/sqm	2802
$CVtu_{dep}$.d	€/sqm	2360

The CV_{dep} was then calculated after having estimated the various $CVtu_{dep}$ figures (Table 9).

Table 9. The CV_{dep} of the Palazzo degli Archivi di Stato building.

Estimated Cost of Reconstruction					
Id.	**Building Proportions and Overall Benchmark Figures**				
As	Total gross floor area	From Table 4		sqm	75,664
Av	Total volume			cm	299,400
A.1	Primary areas (exhibition spaces, offices, conference hall, apartments)			sqm	33,729
A.2	Secondary areas (usable mezzanines, storage rooms, utility rooms)			sqm	20,697
A.3a	Extensions (porticoes)			sqm	14,815
A.3b	Extensions (cloisters)			sqm	2700
A.4	Commercial areas			sqm	1171
A.5	Appurtenances (park)			sqm	2552
$CVtu_{dep}$.a	Overall Physical Cost of Reconstruction: primary areas	CVtu * k_{dep}		€/sqm	2360
$CVtu_{dep}$.b	Overall Physical Cost of Reconstruction: secondary areas			€/sqm	1530
$CVtu_{dep}$.c	Overall Physical Cost of Reconstruction: extensions (porticoes)			€/sqm	1110
$CVtu_{dep}$.d	Overall Physical Cost of Reconstruction: commercial areas			€/sqm	2360
Cea	Cost of renovating exteriors	Source: EUR S.p.A.		€/sqm	61
ID	Cost entries	Source		Amount	
CVt_{dep}	Physical Cost of Reconstruction	(A.1 * CVtudep.a) + (A.2 * CVtudep.b) + (A.3a * CVtudep.c) + (A.4 * CVtudep.d)		€	130,475,000
K.1	Cost of renovating exteriors	(A.3b + A.5) * Cea		€	315,000
K.2	Bureaucratic fees	5%	of CVtdep + K.1	€	6,540,000
K.3	Financial costs	5%	of CVtdep + K.1 + K.2	€	6,867,000
K.4	Profit of company overseeing the reconstruction	5%	of CVtdep + K.1 + K.2 + K.3	€	7,210,000
CV_{dep}	Total	CVt_{dep} + K.1 + K.2 + K.3 + K.4		€	151,407,000

4.3. Result of the DRC Method Application

By adding the MV_{land} to the CV_{dep}, it proved possible to calculate the MV of the State Archives building as €184,562,000, which corresponds to an overall estimated figure of €3870 per sqm (in round numbers), considering a commercial surface area of 47,638 sqm calculated using the following correlation coefficients (in accordance with criteria established by the Real Estate Market Observatory of the Italian Revenue Agency): (i) a correlation coefficient of 100% for primary and commercial areas; (ii) 50% for secondary areas; (iii) 10% for porticoes and cloisters; (iv) 25% for parkland. Compared to the actual sale price, from which an average MV (for the four buildings sold) of €2900/sqm of commercial area can be inferred, the application of the DRC method provides an estimated MV that is approximately 33% higher than the actual sale value. Though the documentation on the estimate is not available, being confidential and not in the public domain, it is held that the factors that led Eur S.p.A. to sell the States Archives Building at a market value of €2900/sqm, a figure below the minimum price quotations cited by the Real Estate Market Observatory of the Italian State Revenues Agency for tertiary properties in the area (Italy's only public databank on real-estate prices), are attributable to specific needs tied to the company's financial deficit, and which made necessary the sale in block of a number of buildings, presumably explaining the lack of thorough preliminary valuation analyses as well.

5. Results: Analysis and Discussion

The results obtained by applying the proposed methodology, show that the crucial step when using the DRC methodology to carry out a valuation of buildings, is the estimate of its CV_{dep}.

The application allowed on the one hand to verify the formal correctness of the operational declination procedure of the DRC here implemented; on the other hand it highlighted some critical issues related to the multiplicity of data to be thus processed to estimate the CV_{dep}, with the related possibility that even one parameter presenting a margin of error or being false can invalidate the results obtainable from the methodology, even if rigorously implemented. As the proposed methodology puts CV_{dep} in close connection with the MV, if CV_{dep} is distorted also MV is incorrect making the results of the procedure unreliable.

Therefore, we believe that the construction of databases with a number of data referring to CV, which are proved to be significant, as processed through statistical models analysing for example the binomial or Gauss distribution, can allow the identification of reliable input data, with consequent robustness of the results.

While acknowledging the applicability of this methodology in different territories, its implementation depends on collecting and employing data strictly connected to the territory in which the property is being valued. From this point of view, the widespread use of the DRC method appears to be related to the availability of significant quantity of data that can be identified as comparable for the asset being valued.

The construction of local databases represents the prerequisite for further improvements to the method proposed here, that could therefore aim to:

- identify coefficients concerning differences in the cost of various construction elements that are 'ordinarily' present, based on a sample of relevant data taken as a benchmark, perhaps using multiple regression models or tools for checking the cost of construction work involving BIM [39–41];
- involve the inclusion of the element of value linked to historical importance in this procedure; as a preliminary consideration, it is held that a regression analysis could lead, in this case as well, and assuming that a significant sampling of sales differentials for buildings of similar size and designated use—with or without monumental features—was available, to the determination of corrective coefficients for application to the result provided by the DRC method in its proposed formulation.

Regarding the use of the results of this paper within the research in progress on the subject, we should stress that at present there is a small number of studies on the DRC method [33–41]; the methodology presented here, is, thus, one of the first available operational variations of DRC, which is already held as one of the three methodologies currently provided by the real estate valuation discipline for the estimate of the MV of a property.

6. Conclusions

The research work carried out and here reported belongs to the study of real estate valuation models. The proposed methodology is interesting in view of the growing demand for valuation of public properties, given that a significant part of those has special characteristics.

Among the three internationally codified methodologies for real estate valuation, it is DRC that makes it possible to assess a property's market value when there is a lack of comparables and/or income data. The DRC method was adjusted to estimate buildings with special features.

The constant scarcity of comparable data for real estate valuation makes the DRC method a procedure, albeit little debated, with significant potential.

Precisely this characteristic has led to the proposing here of a methodology based on transposing the principles inferable from DRC, as codified in the international evaluation standards, into an evaluation procedure.

The application of the proposed methodology made it possible to operationally test the operational capacity of the method itself and to define its limitations, useful for further improvements.

The results of the research work carried out lead us to believe that the proposed methodology has general validity, but requires an articulated set of data, on a local scale, often the availability of which is complex.

However, it should be noted that even with little (but correct) data, the methodology was implementable and gave interesting results.

In fact, while this procedure may be judged to require further work, the results it produced when applied to the Palazzo degli Archivi di Stato building complex have been interesting: compared to the actual sale price, the DRC method generated a significantly higher market value. Such results support the assumption that the DRC method for estimating the market value of buildings is particularly useful when selling public buildings that boast special features.

In light of the results obtained through experimentation, the proposed operative formulation of the DRC method stands as a tool that, when applied to estimates of public real estate, should be used in combination with other valuation tools, in order to arrive at as thorough a calculation as possible of the value of the asset to be sold, thus avoiding—as in the case under examination—sales prices that prove to be anomalous.

Without a doubt, the potential uses of the proposed method include, at the very least, consideration as one of the tools suitable for the validation and confirmation of public real estate estimates carried out under the market or income-based methods.

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