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Integrating the Capital Asset Pricing Model with the Analytic Hierarchy Process and the Delphi Method: a proposed method for estimating the discount rate in constrained real estate development initiatives

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Integrating the Capital Asset Pricing Model with the Analytic Hierarchy Process and the Delphi Method: a proposed method for estimating the discount rate in constrained real estate development initiatives

The legislative framework on territorial and urban planning has become increasingly rich and complex in the European Union, particularly Italy. The structured – and often hindering – system of division of responsibilities between the central State, Regions, local institutions, and organisms generates different levels of administrative verification. The environmental and landscape constraints by which each Public Administration with jurisdiction over the territory exercises its powers strongly impact territorial management and negatively affect investments. Over the years, this has been one of the main reasons behind the significant dilation of the risk and the time required to obtain the necessary authorizations to start construction, producing "business risk." Based on this premise, this work presents a methodological investigation of the relationships between environmental and landscape constraints, the regulatory framework involving the building, and its Market Value. This is finally aimed at finding suitable methods and procedures to formulate a reasonable discount rate considering the constraints and the related regulations that operate on an asset. A multi-step method integrating the Capital Asset Pricing Model, Analytic Hierarchy Process, and Delphi Method is proposed to assess the discount rate component related to urban risk.

1. Introduction

In recent years, the discipline of land governance –all urban planning, landscape, environmental, and building regulations that affect settlement transformations – has become increasingly cumbersome and complex (Battisti et al., 2020).

This complexity is widely recognizable within the European Union. In Italy, it is worsened by the articulated – and often dampening – division of competencies between the central State, Regions, Local Authorities, and other sectorial Institutions with specific scopes. This strongly affects land management and urban planning, negatively affecting real estate investments.

In Italy, in addition to municipal-level provisions (General Regulatory Plan and its regulations, Executive Urban Plans), real estate also depends on a complex system of national and regional laws related to establishing constraints. The system of constraints arises from various sector plans that have joint effectiveness and impose different levels of administrative verification, customarily attributed to specific competencies of public institutions due to the type of matter concerning the constraint.

This complexity significantly affects real estate initiatives connected to urban plans, as well as new construction or building renovation initiatives, particularly where changes in intended use and extensions are envisaged (Oppio et al., 2020); in this regard, the frequent change in the law related to the "regulatory framework of constraints" must also be considered. Indeed, they can impact the regulatory context of already-started authorization processes for productive transformations.

It should be noted that the relationship between constraints and territory is tendentially (not univocally) dynamic: the "regulatory framework of constraints" is constantly changed and updated, modifying the possibilities of intervention on an asset (this happens and produces effects even when real estate authorization processes are underway).

Over the years, this has been one of the causes of the significant extension of the time required to obtain authorizations that allow the start-up of real estate initiatives. In other words, "business risk" grows significantly due to the complex and variable procedural process for approving plans/projects in areas/buildings under constraints (Chong et al., 2009; Chun et al., 2004; Riberio et al., 2017). One more negative factor is the numerical scarcity of personnel employed in Public Administrations dealing with this burdensome workload, which very often results in a delay in the time to complete the investigation and analysis of the Plans and Project to approve (Martinelli and Mininni, 2021); the timeframes provided for by the laws and regulations, based on which the financial assessment of real estate initiatives is performed, are often widely exceeded with repercussion on the economic returns.

The resulting uncertainty, which thus characterizes every real estate initiative in Italy where constraints are present - albeit in different measures depending on the cases and territorial contexts - must be taken into account when proceeding to evaluate a property on which a transformation initiative (real estate development, new construction or refurbishment) and thus an investment opportunity may be envisaged, also in light of the financialization of the real estate sector, which requires transparency on the investment risks on which the profitability of initiatives depends (Chambers et al., 2019; Domian et al., 2015; Sun et al., 2021).

Italy's complex constraint-regulatory system significantly affects the return on real estate initiatives, with significant effects on the Market Value of the asset being transformed (Battisti and Campo, 2021). There is scientific literature related to the study of estimation methods of appropriate discount rates that commensurate the return on industrial capital with the risks and duration of the real estate development initiative (An and Deng, 2009; Brueggeman et al., 1984; Conner and Liang, 2005; Larriv and Linneman, 2022; McDonald, 2015; Napoli et al., 2017; Sagi, 2021; Stokes and Cox, 2023).

In real estate appraisals, the discount rate is a crucial parameter for understanding the investment's return (based on the ability to generate financial/economic flows in both private and public spheres). Still, it is also problematic to define all the factors influencing the investment's risk (inflation trends, condition of financial markets, monetary policy, possibility of alternative investments), which must be considered in its assessment. Unlike financial investments, real estate investment is characterized by high inhomogeneity and fixed position. This makes each investment unique and non-repeatable and requires a specific risk/return profile assessment for the rate's choice (Cannon et al., 2006; Peng, 2016; Ross and Zisler, 1991).

The complex legislative and regulatory system that affects settlement transformation and, thus, the real estate sector has specific effects on the component of the discount rate that scientific nomenclature refers to as "regulatory/administrative risk" (Case et al., 2011; Saaty, 2004). The relationship that links the constraints with the administrative system operating within a given territory (Italy in the case of the study presented) and its corresponding effects on expected returns is a topic of Research that has been the subject of renewed interest in recent times.

Based on the above, this paper investigates the relationships between constraints, the body of laws and regulations to which a building is subject if constrained, and Market Value. The aim is to research methods and procedures for formulating an appropriate discount rate related to the constraints and regulatory measures on an asset.

More in detail, the article presents the results of a research work whose objectives are: i) to create a taxonomy of constraints (landscape, environmental, urban planning) operating on the territory, taking the Italian case as a reference; ii) to perform the methodological definition of a multi-step evaluation procedure, integrating the Analytic Hierarchy Process (AHP) (Linstone and Turoff, 1975; Saaty, 2001), the Delphi Method (DM) (Gordon, 1994; Sharpe, 1964) and the Capital Asset Pricing Method (CAPM) (Alves, 2013; Bartholdy and Peare, 2005; Battisti and Campo, 2021) to ponder the capacity of the various types of constraints to place at certain levels of risk the legitimacy of programs/projects of real estate initiatives. Operationally, the AHP implemented through a DM (to gain experts' opinions about constraints) allows the construction of urban risk indices that, suitably processed, can generate a "fictitious Beta" to implement the CAPM to determine a discount rate that takes into account the appropriate remuneration of the capital (in equity) necessary for the start of the real estate initiative, which can be with certainty transformed/valued only on the sidelines of a complex administrative authorization process.

The proposed procedure is intended to be a functional procedure for the "build-up" approach, where the cap-rate is constructed by considering the incidence of different performance differentials. Through this clarification on the administrative conditions of the asset, the assessment can significantly contribute to the definition of the basket of investments for institutional, qualified, and private investors, given the transparency of real estate players depending on the risks of the action.

While referring to the Italian case, the definition of the method represents an international-level contribution to the implementation of the Highest and Best Use (HBU) (Colavitti and Serra, 2021) as a methodological approach recognized by the Royal Institution of Chartered Surveyors (RICS) in the appraisal of the Market Value of assets that: *i*) need to undergo a transformation; *ii*) have not yet obtained the enabling titles the intervention; *iii*) are characterized by the presence of constraints and/or limitations arising from the laws/regulations in force; in this sense the model is also applicable, subject to appropriate operational declination, in extra-national contexts.

Therefore, in the following: in Section 2, a literary review of the materials and methods investigated in the Research is proposed; in Section 3, the proposed method integrating AHP, DM, and CAPM is illustrated; in Section 4, the expected results of the proposed multi-step method are discussed, and conclusions of the present work are drawn.

2. Materials and methods

A constraint - in detail environmental, landscape, and zoning constraints - is a tool of protection that can completely prohibit, limit, or regulate in detail the transformations of an area and/or a building. Hence, only some constraints lead to the total inhibition of any territorial and/or building transformation. In most cases, a constraint creates pre-conditions for a territorial transformation (both at an urban and building scale).

In general, territorial constraints, which regulate territorial management/transformation, fall into 3 categories: "environmental" constraints, "landscape" constraints, and "zoning" constraints. The latter derive from specific territorial plans aimed at the functional protection of specific territorial infrastructures/equipment.

The individuation of the constraint can occur through delimitations on the maps of the respective competent authorities. Constraints can be established or placed through specific provisions, such as national/regional decrees and laws or landscape plans to regulate this complex theme (European Commission, 2005). Delimitations can be: i) punctual: localized on a single building or a portion of a single building; ii) linear: a buffer zone traced in parallel to the route of a linear element (rivers, power lines); iii) areal: a wide perimeter of any shape, defined according to the specific needs (landscape-related).

In section 2.1, we report a synthesis of the European references for the environmental and landscape constraints; section 2.2 provides a taxonomy of the main constraints from Italian legislation; and finally, section 2.3 summarizes the methods used for estimating the rate in the following paragraph 3.

2.1. Synthesis of the reference European framework

The European Union considers natural resources to be an essential contribution to ecosystemic balance and regions' attractiveness, recreational value, and life quality. This is the primary motivation behind the need for protection and valorization (European Commission, 2020).

Environmental preservation and protection are performed through safeguarding ecological diversity, hydric resources, reconstitution, and protection of ecosystems, including ecological networks, all vulnerable areas with high ecological value, and wetlands, which are part of those networks. To achieve this goal, several ecological elements must be individuated: proximal natural areas, hydric resources, therapeutic climates, and abandoned industrial areas to be redeveloped. Their care requires adequate protective measures, which result in direct constraints or prescriptions of constraints by the Member States.

The legislative framework currently includes several hundred Directives, regulations, and decisions regarding the environment. However, the effectiveness of environmental policy in the European Union largely depends on its national, regional, and local implementation.

At the same time, in some areas, the European Union has directly established regulations in the Member States. The ones with the greatest (territorial) impact are below.

Natura 2000 network

Natura 2000 (European Commission, 2020) is an ecological network of areas that involves all the countries in the European Union and is aimed at guaranteeing long-term protection of habitats and (animal and vegetal) species of community importance due to being rare or endangered. It consists of Special Protection Areas (SPA) and Sites of Community Importance (SCI, which become Special Areas of Conservation, SAC, after the designation process). Natura 2000 derives from two Community Directives on biodiversity: the Birds Directive, which is related to the conservation of wild birds, and the Habitats Directive, which involves the preservation of natural and semi-natural habitats, as well as wild plants and animals. Based on these two Directives, the two typologies of areas are individuated and recognized: the

Birds Directive leads to the institution of SPAs, while the Habitats Directive establishes the institution of SACs. In Italy, the Natura 2000 network consists of 2,299 SCIs, 27 of which have already been designated as SACs and 609 as SPAs. The strong point of the Natura 2000 network is to strengthen the synergies and the balance between nature conservation and biodiversity-respectful human activities. For example, protecting animal and vegetal species related to open mountainous environments is strictly related to preserving traditional agricultural activities, such as pasturing and non-intensive agriculture; hence, these activities are welcome and desirable in those sites. The conservation of sites within the Natura 2000 network also contributes to human well-being through the supply of the ecosystemic services that we depend on - the food we eat, potable water, and fuels – but also through the protection from disasters, such as floods and storms, and the conservation of a stable climate. SPAs and SACs include both completely natural and semi-natural environments (such as traditional rural areas and pastures), often located close to settlements, and can represent a natural shelter for citizens.

Sites of Community Importance (SCI)

The concept of Site of Community Importance (SCI) was defined by Community Directive n. 43 of 21st May 1992 (92/43/CEE), the Council Directive on the Conservation of natural habitats and of wild fauna and flora, also known as the Habitats Directive, adopted in Italy in 1997. According to this Directive, each Member State of the European Union must compose a list of sites (the so-called pSCIs, proposed Sites of Community Importance) that have natural habitats and vegetal and animal species (excluding the birds, protected by Directive 79/409/CEE, or Directive Birds). Based on these lists and through coordination with the States, the Commission drafts a list of Sites of Community Interest (SCIs). Within six years from the declaration of SCI, the area must be declared a Special Area of Conservation (SAC) by the Member State. The goal is to create a European network of SACs and Special Protection Areas (SPAs) for biodiversity conservation, denominated Natura 2000.

Special Protection Areas (SPAs)

Special Protection Areas are located along the migration routes of avifauna. They are aimed at the conservation and organization of suitable habitats for the conservation and management of the populations of migratory wild birds. These areas are individuated by the Member States of the European Union (Directive 79/409/CEE, known as Birds Directive) and, together with Special Areas of Conservation, they make up the Natura 2000 network. All the plans or projects with potentially significant impact on the sites, with no connection and use for their management, must be subjected to the procedure of Environmental Impact Assessment.

Important Bird and Biodiversity Area (IBA)

According to the criteria defined at the international level, Important Bird and Biodiversity Areas (IBAs), previously Important Bird Areas (IBAs), is an area that is considered an important habitat for the conservation of populations of wild birds. As of 2022, there are around 13,600 IBA worldwide, scattered across almost all countries. The individuation of the sites is the responsibility of BirdLife International, which developed the program. These sites are small enough that they are completely preserved and differ from the surrounding area by characteristics, habitats, or ornithological importance. The recognition of a site as IBA requires the presence of at least one of the following characteristics:

- host a relevant number of individuals of one or more globally endangered species;
- be part of a vital area typology for the conservation of specific species (such as wetlands, arid pastures, or the cliffs where marine birds build their nests);
- be a zone with an exceptionally high number of migrating birds.

In Italy, 172 areas have been classified as IBAs, with an overall surface of 4,987 hectares. Currently, only 31.5% of the total land of IBA is designated as Special Protection Areas (SPAs), and an additional 20% has been proposed to be a Site of Community Importance (SCI).

Wetlands of International Importance

The Convention on Wetlands of International Importance (UNESCO, 1971), especially as a habitat for waterfowl, was signed in Ramsar, Iran, on 2nd February 1971. The deed was signed during the "International Conference on the Conservation of Wetlands and Waterfowl," promoted by the International Wetlands and Waterfowl Research Bureau (IWRB), with the collaboration of the International Union for Nature Conservation (IUCN) and the International Council for Bird Preservation (ICBP). The international event led to an institutional turning point in international cooperation for habitat protection, recognizing the importance of the areas defined as "wetlands." These ecosystems have a significantly high degree of biodiversity and represent a vital habitat for waterfowl.

Protection of Cultural and Landscape Heritage in Europe

Concerning landscape, the European Landscape Convention (Council of Europe, 2020) is the first international treaty to be devoted exclusively to the European Landscape as a whole. The Convention was adopted by the Committee of Ministers of the Council of Europe in Strasbourg on the 19th of July 2000. It was open for signature by the Member States of the organization in Florence on the 20th of October 2000. It aims to protect, manage, and plan European landscapes and promote European cooperation.

It is applied to the whole territory of the States: to natural, rural, urban, and periurban spaces. Hence, it equally recognizes exceptional, daily, and decayed landscapes. Currently, 32 Member States of the Council of Europe have ratified the Convention, and 6 signed it. For the first time, the Europe Landscape Convention, signed in Florence on the 20th of October 2000, considers the "landscape" as an autonomous legal form. In the previous international treaties, it had received indirect protection, almost as a reflection of the protection of the cultural heritage (in the UNESCO Convention of 1972); that is, it was attracted into the sphere of environmental protection (e.g., in the 1971 Ramsar Convention on wetlands).

2.2. Taxonomy of constraints in the Italian legislative framework

This section reports a synthesis of the constraints-related regulations, which act on the territory through Laws or higher-level planning tools from which they are directly transposed, impacting the possibilities, modalities, and procedures of urban and building transformations allowed by Municipal urban planning.

Concerning landscape, in Italy, the legislative framework on the protection of landscape, which the European Convention is part of, has a rich story, starting from the Constitution itself. Italy is indeed the first State where the protection of landscape (and the historical and artistic heritage) is one of the main principles of the Constitution. Article 9 of our Fundamental Charter reports two main statements: first, the landscape-cultural heritage binomial is a constitutive element of the national identity; secondly, its protection represents a "primary public function," or rather a primary function of the "Republic," at all its levels: State, Regions, and local institutions.

Cultural and Landscape constraints

They are limitations and, in some cases, specific regulations of the Italian legislation on areas with a particular historical, environmental, or cultural value. In Italy, three typologies of landscape constraints exist: areas constrained with a provision by the competent Authority, areas protected by a Law, and typological categories. The primary legislative reference is represented by the Legislative Decree n. 42/2004 (with its changes and additions), defined as "Code of the Cultural and Landscape Heritage".

Protection of heritage with artistic and historical importance

In this case, the limitations do not affect areas but buildings. This typology of constraint, too, is regulated by the Code of the "Cultural and Landscape Heritage".

In addition to landscape constraints, the Italian legislative framework also includes several environmental constraints.

Hydrogeological constraint

Royal Law Decree n. 3267/1923 "Legislative reorganization and reform on mountain woods and land," which is still in force, subjects "the lands of any nature and in-use destination that, due to forms of use in contrast with the laws established by Articles 7-8-9 (tillage, changes in crop types, and pasturing), may undergo denudation, lose stability, or affect water regimes" (Article 1) to a hydrogeological constraint.

The primary purpose of the hydrogeological constraint is to preserve the physical environment and, hence, to guarantee that all the interventions that affect the territory do not compromise its stability, nor start erosion phenomena, etc., with the risk of public damage, especially in hilly and mountainous areas. The hydrogeological constraint regards lands of any nature and in-use destination but is mainly affixed to mountainous and hilly areas and may involve woodland or non-woodland areas. It must be highlighted that hydrogeological constraints do not always correspond with woodland or forestry constraints, which are also regulated by the Royal Law Decree n. 3267/1923.

Flooding and landslide regulations

The Hydrogeological Structure Plan (in Italian denomination Piano per l'Assetto Idrogeologico, P.A.I.) is a fundamental tool of territorial government, established by Law 183/1989. P.A.I., depending on the risk of overflow and landslide risk, can impose limitations on land transformation activities, regardless of whether the hydrogeological constraint exists or not. When watershed planning is started in any region, it represents its thematic and functional base. The P.A.I., drafted under Article 17, paragraph 6 ter, of Law 183/89, and of Article 1, paragraph 1, of Law Decree 180/98, converted with amendments by Law 267/98, and of Article 1 bis of Law Decree 279/2000, converted with amendments by Law 365/2000, has the value of Sector Territorial Plan and is the knowledge, legislative, and technical-operational tool for the planning and programming of actions, interventions, and implementation norms concerning the defense from territorial hydrogeological risk. Following the coming into force of the Consolidated Environment Act (Legislative Decree 152/2006), this subject is regulated by Articles 67 and 68 of the latter. The P.A.I. has three main functions: i) knowledge acquisition, which includes the study of the physical environment and the anthropic system, and the recognition of existing territorial and urban plans, hydrogeological and landscape constraints; ii) regulatory and prescriptive function, destined for the activities connected with the protection of land and water, until the assessment of the hydrogeological risk and the following constraining activity, through extraordinary and ordinary provisions; iii) planning function, providing possible intervention methodologies aimed at risk mitigation, estimating the required financial commitment, and establishing the time distribution of interventions.

Protected areas

The first regulatory tool to establish key principles for the institution and management of protected areas is certainly Law 394/1991 on protected areas, the "Framework Law on protected areas." Law 394/1991 submits specific territories to a special protection and management regime.

According to the provisions of Article 2, Law 394/1991, protected areas are classified according to their characteristics into: i) national parks, constituted by land, river, lake, or marine areas that contain one or more ecosystems being untouched or also partially altered by anthropic interventions, and one or more physical, geological, geomorphological, biological formations whose international or national relevance for naturalistic, scientific, aesthetical, cultural, educational, and recreational values, requires the State's intervention for their conservation to present and future generations; ii) regional natural parks: land, river, lake areas, and also sea stretches overlooking the coast, with naturalistic and environmental value, which constitute a homogenous system for the natural configuration of the places, landscape and artistic values, and traditional cultures of local populations, within one Region or across multiple adjacent Regions; iii) natural reserves: land, river, lake, or marine areas that contain one or more naturally relevant animal and vegetal species, that is they contain one or more important ecosystems for their biological diversity or for the conservation of genetic resources. Nature reserves can be national or regional, depending on the relevance of their values; iv) protected marine areas: this category encompasses the areas defined by the Geneva Protocol, related to the Mediterranean areas detailed in Law 127/1985 (including the ratification of the protocol related to special protected Mediterranean areas, open for signature in Geneva on the 3rd of April 1982) and those defined according to Law 979/1982 (Provisions for the safeguard of the sea).

Zoning constraints

In territorial and urban planning, constraints are mainly established through the individuation of areas or buffer zones, which represent limitations to building activity, for the protection of relevant general interests (such as safety, hygiene, and health) directly imposed by the Law or urban planning tools, and regarding specific parts of the territory, located near artifacts or places involving public use (streets, highways, railway lines, graveyards, etc.). They are mainly distancing impositions. Zoning constraints are different, as they can be absolute or relative. Some typologies of zoning constraints include minimum distances to protect the road belt, minimum distances to protect the railway track, distances from airports; cemetery area respect; buffer zones for power lines, aqueducts, and methane pipelines; buffer zones for military works; buffer zones for water extraction points, at the service of human consumption; buffer zone for sewage treatment plants, buffer zones for radio and television broadcasting stations.

2.3. Analytic Hierarchy Process, Delphi Method, and Capital Asset Pricing Model

This section aims to synthesize an outline of the structures of AHP, DM, and CAPM (Fig. 1).

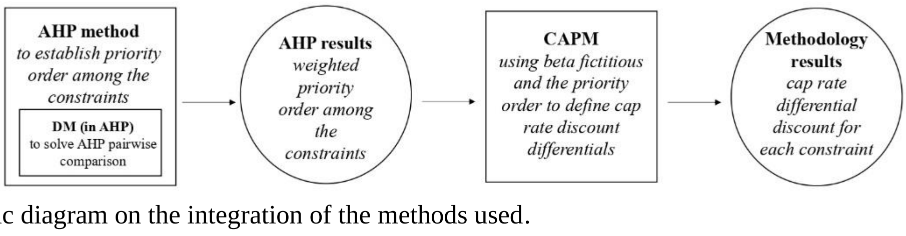

Figure 1. Synthetic diagram on the integration of the methods used.

These methods have already been widely tested in the scientific literature and used in common practice.

AHP is a multi-criteria decision support system that compares several alternatives according to quantitative and qualitative criteria based on pairwise comparisons (Saaty 2004; Saaty 2001). Among the various multi-criteria analysis methods available in the scientific literature, AHP has been considered as it allows, also thanks to Saaty's semantic scale, an easy pairwise comparison between the elements that constitute the evaluation. Such a comparison allows for defining an order of importance for the various constraints that may intervene in a settlement transformation initiative.

The AHP process is broken down as follows:

- it starts with the definition of different alternatives to be ranked and decision criteria, that is, the factors to consider in the decision;
- the "evaluation problem" must be structured according to a hierarchy: first is the general goal, from which specific goals derive, then criteria are defined from specific goals, and indicators are associated with them. It is possible to attribute specific importance to each criterion through weight. Through a pairwise comparison related to the importance of each factor at every level (performance of the alternatives with respect to a single criterion, criteria with respect to specific goals, and specific goals with respect to the general goal), it is possible to insert dominance coefficients in the pairwise comparison matrix, using Saaty's semantic scale. Saaty's semantic scale allows one to make a "weighted" judgment based on one's co-knowledge and experience regarding the comparison of evaluation items;
- after defining the problem and establishing criteria and alternatives, it is necessary to set the A matrix, an n x n matrix with the pairwise comparisons between the selected criteria, to attribute to each of them a preference degree (weight) with respect to the others. As mentioned above, preference degrees are attributed according to Saaty's scale;
- to guarantee an objective attribution judgment for the criteria preference degree, the decision-maker's opinion might be inadequate. For this reason, AHP is often supported by ad-hoc methods or tools for evaluating the degree of preference. These include the analysis of experts' points of view, carried out by Delphi Method, described in the following section;
- after acquiring the experts' opinions, it is possible to attribute a weight to each criterion and hence proceed with calculating the vector with the criteria priorities. The latter, too, are hierarchized according to the degree of preference. After calculating the vector with the criteria priority, the following step is the verification of its Consistency Ratio (*CR*), which is equal to:

  $$CR = \frac{CI}{RI} \quad (1)$$

  while the Consistency Index (*CI*) is:

  $$CI = \frac{\lambda max - n}{n-1} \quad (2)$$

  where:
  λmax represents the maximum eigenvector of the A matrix of criteria, while n is its dimension.
  RI is the Random Index, a tabulated value associated with the size of the A matrix of criteria. The A matrix is considered to be consistent if *CR* <0,1 (10%);
- after verifying the Consistency Ratio, the final step is the hierarchization of alternatives (and the resolution of the evaluation problem). n B matrices with m x m size are defined, assigning a preference degree between alternatives with respect to the selected criteria. In this case, a priority vector is also calculated for each of the n matrices. At the end of this process, obtaining the hierarchy between alternatives is always possible.

As mentioned above, within AHP, attributing a degree of preference between the criteria is fundamental for correctly resolving the evaluation problem. For this purpose, experts are consulted: this refers to subjects with a recognized experience and knowledge in the field of investigation/object of the problem. In the literature, the process of expert individuation is not methodologically standardized, but there are some best practices to follow:

- definition of the scope of the investigation in which the judgment is required;
- definition of the skills to seek in the experts: the expert must have proven knowledge in the field of investigation/object of the problem;
- choice of the criteria for the verification of their knowledge, such as *i*) criterion 1: publications in the subjects in which the experience is required (monographs, contributions to collective volumes, articles in national and international journals, etc.); *ii*) criterion 2: degrees (PhD, specialization courses, masters concerning the subjects under evaluation); *iii*) criterion 3: professional skills and experiences.

After individuating the experts, defining the most suitable consultation technique is fundamental. Consultation techniques refer to critical listening to the subjects' (experts') opinions to expand the knowledge base on the problem under evaluation.

There are several techniques to achieve consensus which have a specific role and are applied to support the decision-making process if a lack of scientific evidence characterizes the research context, or if they are not demonstrated or fully shared, or even in the case of contradictions between the pieces of evidence or the sources that generated them, resulting in a misaligned picture, within which a reference point or shared guidelines must be sought. These techniques can include experts, stakeholders, or both of them. Can be mentioned:

- The Delphi Method is a typical methodology of social research whereby a selected group (also known as a panel) of experts are interviewed anonymously to express their views and opinions on a given topic, to validate some of them through mutual comparison and progressive sharing (Gordon, 1994; Linstone and Turoff, 1975; Pretty and Hine, 1999);
- Focus Group: a discussion among a limited number of experts with the presence of the decision-maker, often supported by a tutor, to describe the nature and the main characteristics of a problem (Mattia, 2008);
- Interviews: qualitative interviews are "extended" conversations between the researcher and interviewed people, during which the researcher tries to obtain as detailed and in-depth information as possible on the research theme (Mattia, 2008);
- Questionnaire: an observation tool to quantify and compare the data collected on a population sample chosen according to the characteristics of the evaluation (Mattia, 2008).

The CAPM is a model that explains the capital market price formation mechanism. It allows for determining the suitable expected return or discount rate considering the characteristics of the (generally financial) activity under evaluation (discounted cash flows generated by the activity) in relation to its risk (Faiteh and Aasri, 2022; Mattia, 2008; Pretty and Hine, 1999).

The most common formula of the CAPM is (Sharpe, 1964):

$$r_a = r_f + \beta_a * \left(r_m - r_f\right) \qquad (3)$$

where:

r_a = expected return on investment (in this case, asset);

r_m = expected return of the market or its segment (in this case, real estate market);

r_f = risk-free rate;

β_a = Beta coefficient of the investment (in this case, asset), that is, the sensitivity coefficient of the stock to the market (Battisti and Campo, 2021).

In the CAPM, a particularly interesting element is the Beta coefficient, which synthesizes the relationship between the average market return rate and a specific return rate through the risk associated with an asset (Tang and Way, 2003).

In this sense, by expressing the covariance between a single stock and the whole market, it provides the simplest measurement of systematic risk and, hence, information on the volatility and liquidity of the market. It is a simple risk index of a coefficient with practical use. Within the use of the CAPM in finance, there is comprehensive literature on estimating the Beta coefficient. The following proposal of a multi-step method starts with considering a fictitious Beta to estimate the discount rate in real estate development actions; AHP and DM are conjunctly used for estimation.

3. Methodological proposal

The proposed multi-step method's structure is based on AHP, DM, and CAPM and aims to determine a discount rate that takes into account constraints and the regulatory framework that can affect urban transformation; the discount rate can hence be used to appraise the Market Value of buildings that can be subjected to real estate development (pre-transformation or Transformation Value).

In detail, the proposed method aims to evaluate the so-called "regulatory/administrative risk" within the specific discount rate of an asset subject to a transformation intervention (that is, it will be transformed only at the end of a complex administrative authorization process). This discount rate component is a key element for estimating the pre-transformation Market Value. It also provides a parameter for the profitability of the initial capital that will be immobilized for the acquisition of the asset to transform.

Determining the discount rate in relation to real estate development risk can help define the real estate players' basket of investments.

The proposed method is articulated into 2 macro-phases:

1) the first, general, phase is aimed at the transformation of the constraints of a given context into a range of discount rate differentials depending on the same framework of constraints that affect the "regulatory/administrative risk" component;
2) the second (specific) phase aims to define a specific discount rate for the building in relation to the regulatory/administrative risk that can be envisaged in the valorization action.

Phase 1 is divided into the following actions:

1) recognition of the constraints within a specific territorial context, affecting territorial transformations (excluding not-buildability constraints);
2) application of the AHP, conjunctly with the DM, for the hierarchization of constraints (according to their importance) to attribute an importance index to (national) constraints. The AHP, carried out using Delphi Method results obtained with the support of experts in regulatory/administrative subjects (public officials of Regional Direction of the Urban Planning sector), will perform the pairwise comparison of each territorial constraint within the area, based on the elements that characterize the constraint itself, inferred from regulations (Acampa et al., 2021). Two criteria are used: i) capacity to inhibit the transformation and ii) administrative-procedural time to verify the compatibility/conformity with the constraint. The capacity to inhibit the transformation is intended as the complexity of the constraint (so-called "vesting") and the verification process to which it is subjected (compatibility/conformity, or both). The administrative-procedural times for verifying compatibility/conformity with the constraint are related to the average time needed by the competent authorities of the given constraint to elaborate on the authorization/nihil obstat request and issue the related provision. The objective of this phase is to obtain weights/coefficients (as a result of the AHP) that, after suitable elaboration, can provide valuable indications on the specific discount rate of a real estate development initiative in a constrained area. Each potential constraint in a given territorial area is associated with a score resulting from the AHP; these scores represent the "base" dataset to elaborate or normalize to proceed to the estimation of the fictitious Beta of the CAPM.

Phase 2 is articulated into the following actions:

1) identification of the fringe parameters related to the financial Beta coefficient of the CAPM. The proposed procedure considers numerical fringe values that, in the market, express the beta coefficient, which can be regarded as related to a riskless investment (minimum parameter) or a high-risk investment (maximum acceptability by an investor). Fringe values are related to the context where an asset has to be transformed or built, hence expressing the risk components connected to the context, thus the market, inflation, etc.;
2) conversion of AHP results (scores representing hierarchical ratios) into coefficients between the minimum and maximum Beta. In brief, the point is to interpolate AHP results within a value scale between the minimum and the maximum Beta. The interpolation leads to transforming "real Beta" coefficients related to the financial market into fictitious Beta coefficients associated with the real estate market and in the specific segment of real estate development. In particular, each constraint (within the taxonomy of a specific territorial context) is associated with a variation of the fictitious Beta. To implement the AHP, a DM has to be carried out considering the Experts' points of view regarding the relation between constraints (environmental and landscape); in other words, Experts solve the AHP pairwise comparison;
3) the obtained fictitious Beta coefficients can be used in the Capital Asset Pricing Model (CAPM); in particular, they contribute to the determination of the "overall fictitious Beta" coefficient referred to a given asset to be transformed. Beta values above 1 imply a higher risk than the average market (constraint condition above the average, associated with an expected lower "reactivity" in the conclusion of the authorization procedure, which remains under risk); instead, Beta values below 1 correspond to a lower risk. It is evident that the overall fictitious Beta, whose estimation is based on the increase in the risk of the transformation of the asset due to the constraints, embeds the risk that is generally defined in the scientific literature as "regulatory/administrative" but it does not include all the multiple variables underlying the return rate, which also depend from other factors (generally: sector, location, typology, technical and financial aspects); in this case, these additional elements can be overlooked if the considered market return r_m has no time and location inhomogeneity (with respect to the asset under evaluation). Considering the above, considering results from AHP implementation (phase 2.2), this phase is implemented through the summation of the variables of fictitious Beta associated with constraints, only in relation to the constraints that are present on the asset to transform, according to the formula:

$$\beta_a = f(v_1 + v_2 + v_3 + \cdots + v_n) \quad (4)$$

4) Implementation of the CAPM in its traditional formulation: the result of the implementation of the CAPM is a discount rate that is calibrated on the specific constraint condition of the asset (deriving from the elaboration of the regulatory/administrative risk in one coefficient through AHP and DM), but also related to its historical-temporal-geographic context (deriving from the adoption of fringe parameters related to specific contexts and periods). After determining the expected return through the CAPM, the future cash flows of the analysed financial activity can be discounted, determining their current value. The discount

operation allows for determining the correct price for the financial activity. Hence, a riskier real estate development will have a higher Beta value and will be discounted at a higher rate; less risky financial activities will have lower Beta values and will be discounted at lower rates.

4. Experimentation and results

The proposed methodological approach has been tested using the Lazio Region as a reference. The experimentation considered the main types of constraints present within the regional territory (phase 1.1) that affect settlement transformations of a landscape and environmental nature.

The experimentation is conducted with a basic assumption: each of the constraints considered acts as a limitation to the right to build but not as an inhibition: the constraints considered are not of absolute unbuildability since they would, in such a case, be configured within the evaluation process as “barring criteria,” in that they inhibit any possible transformation of the asset to which the constraint discipline applies. In the present case, it must be assumed that what is being tested is valid within the areas that have the following landscape classification from the Regional Territorial Landscape Plan: Landscape of Urban Settlements, Landscape of Evolving Settlements.

With reference to the literary review conducted in Sec. 2, 6 types of constraint summarized in Table 1 were considered. It should be noted that the experimentation is performed on the types of constraint, that is, on the categories of constraint that encompass, within them, different constraint cases. It is methodologically correct to proceed by focalizing the assessment on the constraint categories since, within each category, only one constraint is usually evident. Even where special (and rare) circumstances produce the coexistence of a double constraint of the same categories, with specific reference to the case of the Lazio Region, it is found that the constraint discipline remains the same with one or more constraints of the same category. For example, in the case of a double constraint under Art. 134 c. 1 lett. b) of Legislative Decree No. 42/2004, due to the mouth of a river (coastal territory and river), the level of protection appears to be the same compared to the case of single constraints due to either the coastal territory or the river.

Table 1. Constraint categories considered in the experiment.

Types of constraints being tested	
Properties and areas of significant public interest (Article 134, paragraph 1 (a), Legislative Decree No. 42/2004)	(a) immovable things having conspicuous features of natural beauty, geological singularity, or historical memory, including monumental trees; (b) villas, gardens, and parks not protected by the provisions of Part Two of this Code, which are distinguished by their uncommon beauty; (c) complexes of immovable things that make up a characteristic appearance having aesthetic and traditional value, including historic centers and cores; (d) scenic beauties, and so are those viewpoints or belvederes accessible to the public, from which the spectacle of those beauties is enjoyed.
Areas protected by Law (Article 134, paragraph 1 (b), Legislative Decree No. 42/2004)	(a) coastal territories included in a belt of a depth of 300 meters from the shoreline, including for land elevated on the sea; (b) the territories conterminous to lakes included in a strip of a depth of 300 meters from the shoreline, including for elevated lands on lakes; (c) rivers, streams, and watercourses included in the lists provided for in the Consolidated Text of the legal provisions on water and electrical installations, approved by Royal Decree No. 1775 of December 11, 1933, and their banks or foot of the banks for a strip of 150 meters each (d) mountains for the portion exceeding 1,600 meters above sea level for the Alpine chain and 1,200 meters above sea level for the Apennine chain and islands; (e) glaciers and glacial cirques; (f) national or regional parks and reserves, as well as the external protection territories of parks; (g) territories covered by forests and woodlands, even if they have been traversed or damaged by fire, and those subject to reforestation constraints, as defined by Article 2, paragraphs 2 and 6, of Legislative Decree No. 227 of May 18, 2001 (repealed provision, now the reference is to Articles 3 and 4 of Legislative Decree No. 34 of 2018) (h) areas assigned to agricultural universities and areas encumbered by civic uses; (i) wetlands included in the list provided for in Presidential Decree No. 448 of March 13, 1976; (l) volcanoes; (m) areas of archaeological interest.
Properties and areas protected by landscape plans (Article 134, paragraph 1, letter c), Legislative Decree No. 42/2004)	Identification, if any, of additional properties or areas of considerable public interest in terms of Article 134, paragraph 1, letter c), their delimitation and representation on a scale suitable for identification, as well as determination of the specific use prescriptions, in terms of Article 138, paragraph 1; identification of any, additional contexts, other than those indicated in Article 134, to be subject to specific safeguard and use measures.
Areas subject to hydrogeological constraints	Lands of any nature and use which, as a result of forms of use that conflict with the regulations in Articles 7, 8, and 9 (clearing, changes of cultivation, and grazing), may, to the public detriment, be denuded, lose stability or disturb the water regime.
Areas placed under protection by the Hydrogeological Structure Plan.	Areas under flood hazard protection, areas under landslide hazard protection, and areas under flood and landslide hazard protection.
Rete Natura 2000	Zone: SCI; SPA; IBA.

Having defined the list of constraint categories being tested, both the prodromal hierarchy for AHP implementation and the DM (step 2.2) were structured.

The pairwise comparison of the 6 constraints considered was done through a DM implemented by involving a panel of no. 25 experts structured as follows:

- no. 6 officials with organizational positions in landscape matters serving in the Lazio Region;
- no. 7 officials with organizational positions in environmental matters in service at the Lazio Region;
- no. 12 among managers and officials with urban planning competencies at Local Authorities.

The pairwise comparison is carried out considering the incidence of the constraint with respect to the criticality and the consequent risk of failure of the initiative, as well as the completeness/absence of normative and/or regulatory references capable of governing the constraint. Each of the DM participants was asked to perform the 15 pairwise comparisons by responding to the question: *"Which of the two types of constraint involves more criticality in settlement transformation processes? The expert considers the vulnerability of the constrained asset type, any mitigation measures and associated costs, and their track record. There remains the possibility of not answering where adequate knowledge is not available".*

Phase 1 of the DM involved aggregating the experts' judgments. The judgments were aggregated by means of a simple average. Therefore, the figure to be used for the AHP, indicative of the criticality ratio for each of the 15 pairwise comparisons, was derived from the averages of the DM results. The outcomes of the pairwise comparisons are reported below in Table 2.

Table 2. Pairwise comparisons.

Pairwise comparisons						
	1	**2**	**3**	**4**	**5**	**6**
1	1	0.33	4.00	7.00	0.20	3.00
2	3.00	1	6.00	6.00	1.00	5.00
3	0.25	0.17	1	4.00	0.17	1.00
4	0.14	0.17	0.25	1	0.12	0.33
5	5.00	1.00	6.00	8.00	1	8.00
6	0.33	0.20	1.00	3.00	0.12	1

Thus, it was possible to implement the AHP using the open-access software BPMSG. The results of the implementation are as follows:

- number of comparisons = 15;
- Consistency Ratio (CR) = 6.1%;
- Consistency Index (CI) = 1,24;
- Principal eigen value = 6,38;
- Eigenvector solution: 6 iterations, delta = 6,7E-9.

These data give the experimental results good robustness and thus denote them as acceptable. The AHP results are shown below in Fig. 2.

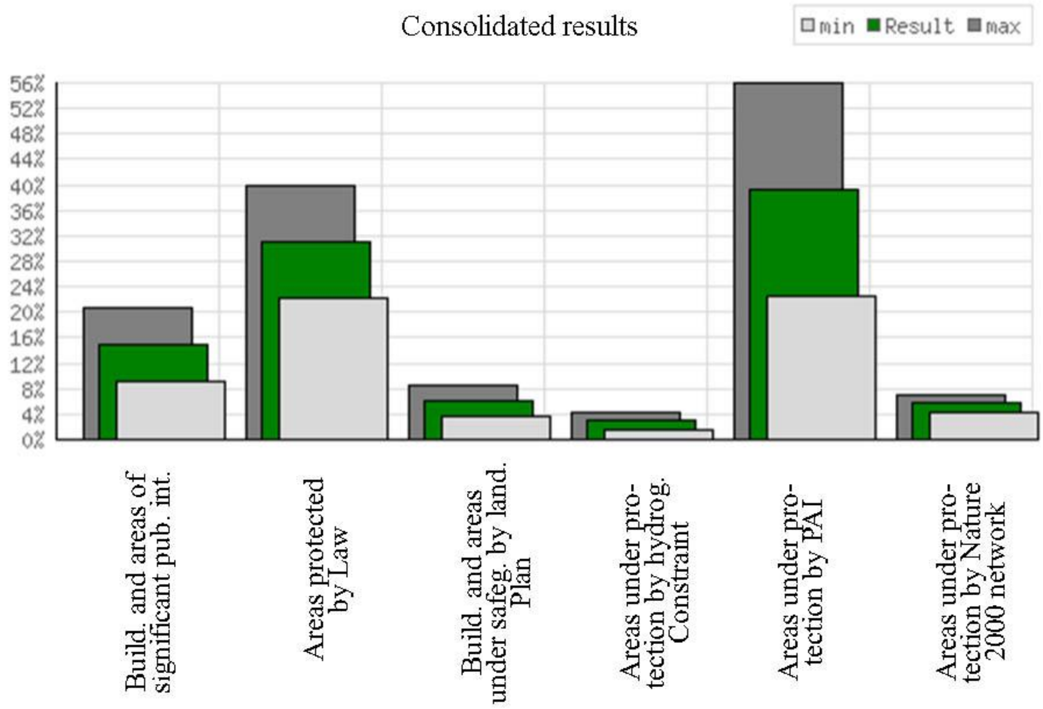

Figure 2. AHP results.

The AHP results, consisting of a preference scale, need to be interpolated to be used in CAPM; preliminarily, it proved necessary to find data on maximum and minimum Betas (step 2.1) obtainable in the market. In this regard, the information source was https://www.infrontanalytics.com/, from which the following were obtained for the real estate sector:

- maximum Beta: 7.12;
- minimum Beta: 0.78.

Based on these values, it was thus possible to convert the AHP results into beta coefficients (Tab. 3). Since, as can be inferred in the scientific literature, urban planning risk affects a portion of the real estate risk premium, the fictitious Beta coefficients are reduced by a percentage, conventionally established (and in any case considered congruous) in the present experiment of 40 percent, corresponding to an assumed incidence of the constraint component in urban planning risk, on the entire real estate risk premium (step 2.2).

Table 3. AHP results and fictitious Beta appraisal.

AHP results and fictitious Beta appraisal						
Constraints		**Priority**	**Rank**	**(+)**	**(-)**	**Fictitious Beta incidence**
1	Build. and areas of significant pub. int.	14.90%	3	5.8%	5.8%	0.424
2	Areas protected by Law	31.00%	2	9.0%	9.0%	0.883
3	Build. and areas under safeg. by land. Plan	6.10%	4	2.5%	2.5%	0.174
4	Areas under protection by hydrog. Constraint	2.90%	6	1.5%	1.5%	0.083
5	Areas under protection by PAI	39.40%	1	16.7%	16.7%	1.122
6	Areas under protection by Nature 2000 network	5.70%	5	1.3%	1.3%	0.162

To test the veracity of the results, the simulation of 3 sample cases, with the obtained values, is proposed.

The simulation considers the following:

- r_m = industry average return equal to 12%, deduced from the scientific literature (Forte and De Rossi, 1974; Ibbotson and Siegel, 1984);
- r_f = risk-free return equal to 3%, taken as a function of the net yield on government bonds (Italian BTPs).

Simulations should be done considering 3 different risk situations that would flow into the Beta (step 2.3):

i) maximum risk hypothesis, with the co-presence of multiple constraints of different nature and, in detail of constraints 1, 2, 3, 4, 5, 6;

ii) medium risk hypothesis, with the co-presence of constraint 1, 4, 5;

iii) low-risk hypothesis, without the presence of constraints.

From the implementation of the CAPM we will have (step 2.4):

$$r_a = r_f + \beta_a * (r_m - r_f) \tag{5}$$

$$r_a = 0{,}03 + \beta_a * (0{,}12 - 0{,}03) \tag{6}$$

It is thus possible to identify the discount rate in the three simulations (step 2.4).

In the case of hypothesis 1, r_a will be:

$$r_a = 0{,}03 + 2{,}068 * (0{,}12 - 0{,}03) = 0{,}216 \tag{7}$$

In the case of hypothesis 2, r_a will be:

$$r_a = 0{,}03 + 1{,}241 * (0{,}12 - 0{,}03) = 0{,}142 \tag{8}$$

In the case of hypothesis 3, r_a will be:

$$r_a = 0{,}03 + 0{,}78 * (0{,}12 - 0{,}03) = 0{,}1 \tag{9}$$

Thus, the expected returns under the three assumptions considered - assuming that the additional conditions that characterize real estate-related investments are ordinary - 21.6%, 14.2 %, and 10%, respectively.

These percentages, derive from a comparative approach: the international financial market sees real estate, as one of the possible sectors of investment and therefore the allocation of capital is made on the basis of risk. The proposed method in fact, using parameters inferred from the financial market, returns results that in fact allow a reading that is comparable between investments. Therefore, the investor who is in condition A must be able to have an IRR of 21.6 percent in order to allocate the resources available to him or her, the investor who is in condition B, on the other hand, must be able to have an IRR of 14.2 percent, while the investor who is in condition C must be able to have an IRR of 10 percent.

Even if the properties were similar or equivalent, the legal condition dictated by the restrictions on them substantially differentiates the financial transactions to be undertaken by implying different returns on investments.

5. Discussion and conclusions

This article presents the first results of research aimed at investigating the relationship between constraining aspects and the Market Value of assets that lend themselves to real estate development initiatives but are not yet the subject of title, enabling their transformation.

The results obtained with the experimentation return discount rates appear credible compared with the returns expected by operators; a remuneration of 10% is found to be adequate for real estate investments with low urban planning risk, while a percentage of 21% appears congruous for situations characterized by greater procedural uncertainty, in this case connected to the constraining condition to which the asset is subject.

The financialization of the real estate market, which examines real estate development interventions on assets to be transformed into assets subject to investment, has made it plausible to use a method, the CAPM, typically used to determine the relationship between a security's yield and its riskiness, measured through a single risk factor called Beta.

The proposed CAPM provides expected return via a fictitious Beta, which is the object sought by the proposed method, configured as a discount rate appropriate to the characteristics of the financial asset underlying the real estate development intervention.

Based on the proposed methodology, the return depends on the “notional” Beta coefficient, which measures the responsiveness of the expected return in relation to the property’s constraining condition, on which the allowability of the intervention depends.

Like in financial markets, the higher the Beta coefficient, the higher the expected return of asset n because it possesses a higher degree of non-diversifiable risk. An investor will, therefore, demand a higher expected return for holding a riskier financial asset (Baum, 2020; Jordà et al., 2019; Wong and Ka, 2017).

The proposed procedure implicitly associates a return with the chances of success (regardless of the industry sector in which it occurs), referencing the range of returns expressed by the financial market in a given geographical context and at a given historical moment.

Further development of this research is related to more experimental detail in which a fictitious Beta is defined in relation not only to the types of constraints but specifically to the constraints and their possible combinations.

Despite this, there must be considered limitations in the proposed method which, considering the financialization of the real estate market over the past two decades, places financial and real estate investments on very similar planes; in fact, these are two areas of investment that can move with different logics.In summary, the proposed method can be seen as a tool for investors who want to reduce error margins in estimates of properties with complex administrative and constraint conditions, increasing transparency about investment risks on which profitability depends.

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