Cities 178 (2026) 107380

Contents lists available at ScienceDirect

Cities

journal homepage: www.elsevier.com/locate/cities

Out of business: design constraints and financial burdens in repurposing dead shopping malls

Sergio Copiello [a,*], Mauro Cristina Marzo [a], Eleonora Morbin [a], Pietro Bonifaci [a]

[a] University IUAV of Venice, Department of Architecture, Santa Croce 191, 30135, Venice, Italy

ARTICLE INFO

Keywords:
Retail apocalypse
Brick-and-mortar shopping malls
De-malling
Re-malling
Analytical Hierarchy Process
Discounted Cash Flow Analysis

ABSTRACT

The paper explores adaptive reuse options for abandoned shopping malls amid the so-called retail apocalypse, defined as the widespread closure of brick-and-mortar retail stores, largely driven by the rise of e-commerce and shifting consumer behavior. The research question deals with returning dead shopping centers to productive use through technically feasible and financially viable conversions. The focus is on repurposing rather than demolishing-and-rebuilding solutions, to reconcile functional obsolescence with substantial residual structural life. The four-stage methodology includes: identification of alternatives and criteria through a literature review; alternative ranking using multi-criteria evaluation, specifically the Analytical Hierarchy Process; concept design and cost appraisal; economic valuation using Discounted Cash Flow analysis and Monte Carlo simulation. The method is tested on a case study identified with a survey of Italian dead and dying malls. Out of nine potential repurposing options, multi-criteria evaluation prioritizes a data center, followed by senior housing and a medical facility. Concept design tests suggest minimal invasive works for a data center, versus extensive reconfiguration for the residential and healthcare options. Base-case cash-flow analysis yields net present values and internal rates of return of €12.8 M/7.7% for the data center, €3.4 M/5.3% for senior housing, and €2.2 M/4.4% for the medical facility. Economic viability ranking is sensitive to changes in the discount rate. Results are also strongly affected by changes in revenue fundamentals. Simulation analysis shows that, depending on those fundamentals, the probability that the net present value exceeds zero is 75%, 85%, and barely 50%, respectively. Property book value hinders the feasibility of repurposing.

1. Introduction

Over the last fifteen years, a steadily increasing number of brick-and-mortar shopping malls and other retail stores have closed and been abandoned in the US. *Retail Apocalypse* (RA from now on) is the expression coined to denote this phenomenon (Berry, 2025) (Fig. 1). A series of articles featured in magazines, business newspapers, and similar outlets enquire into the driving forces of the so-called RA; a couple of examples can be found here (Biron, 2019; Peterson, 2018; Thompson, 2017). There, the underlying reason is alleged to be twofold: on the one hand, the 2008 global financial crisis is often described as the spark that set it off; on the other hand, the rise and success of e-commerce are deemed to have further fueled the phenomenon. Besides, other interrelated causes are identified as follows (Fig. 2). Oversupply of shopping malls, leading to fierce competition, is recognized as a key reason for retail decline dating back to at least the mid-1990s and early 2000s (Lange, 2022),[1] possibly due to the large availability of finance capital to invest in commercial real estate during the 1980s (Warf, 1994).[2] A concurrent shift in consumers' preferences and behavior is likely to play a role, too (Philipose, 2019).[3] They are prone to substituting the time spent wandering in brick-and-mortar malls with time spent shopping online from the couch, and they may also be

* Corresponding author.
E-mail address: sergio.copiello@iuav.it (S. Copiello).

[1] "The number of malls and shopping centers has continued to rise, peaking […] in 2017, outpacing population growth, which has been dropping since 1993." (p. 223).

[2] "Inevitably, the enormous surge of commercial real estate construction brought with it the seeds of its own demise. Supply became severed from demand […]" (p. 322).

[3] "Customers show no mercy to retailers, whether big or small. It's not just mom and pop that gets killed off by the public. Retail goliaths have also been slain over the last few decades." (pp. 3, 4).

https://doi.org/10.1016/j.cities.2026.107380
Received 15 March 2026; Received in revised form 7 June 2026; Accepted 1 July 2026
Available online 8 July 2026

inclined to replace the consumption of non-essential material goods with the use of entertainment and leisure services (Elmashhara & Soares, 2019). In addition, technological advancement is not foreign to the prospective demise of shops as places where transactions between customers and suppliers are settled. The rise of smartphones equipped with touchscreens, not to mention fast, portable internet access, represents a boost to the digitalization of several industries – from books to movies, from music to photography – thus leading people away from brick-and-mortar retail stores. Even far after the great recession of the late 2000s, several major retail chains are brought to the brink of bankruptcy – and some are actually seen filing for bankruptcy – due to the heavy debt burden incurred as a consequence of leveraged buyout transactions. When financial struggles – such as the inability to pay off debt – hit important chains, malls risk losing an anchor tenant, which in turn can trigger a vicious circle: the pool of customers shrinks, additional stores close, and so forth. Finally, the Covid-19 pandemic is identified as a further contingent reason, acting both directly in the short term - as customers are forcibly kept away from indoor malls, and foot traffic falls (Roggeveen & Sethuraman, 2020) – and indirectly in the long run – as customers are incentivized to move toward e-commerce (Beckers et al., 2021; Sheth, 2020).

The use of the expression RA as a metaphor for the changes the retail industry is experiencing has also been criticized. In brief, the reasons for that are as follows. The dropping number of operating malls does not tell the whole story, as larger shopping centers are substituting smaller ones; thus, the availability of gross leasable area (GLA) is less affected by the phenomenon. Even though at a pace slower than that characterizing e-commerce, the sales volume in physical marketplaces is still growing. Depending on company strategies adopted in the last few years, while several retail chains are struggling, others are thriving. The downsizing of some retail chains can be seen as no more than a market correction due to an oversupply of stores.

Nonetheless, supporters and critics of RA occurrences agree that the retail industry landscape is changing. As the conditions for a further drop in retail stores and shopping malls are bound to persist over the years, the phenomenon is expected to continue and reveal itself through several forms: additional abandoned commercial buildings and empty parking lots populating the urban environment, urban decay as a side effect of job losses and reduction in neighborhood services, shifts in traffic flows, and wealth loss as property values drop (Kickert et al., 2020). This framework leads to the research question we address here. What should we do with the wrecks of the physical retail era, and, especially, how can we bring them to a new life? A brief digression is in order to explain this study's aim and scope in full detail. While looking at a dead brick-and-mortar mall, one might wonder: should we not tear it down and rebuild something different from scratch? Although the question makes sense, this paper is not meant to compare the refurbishing and rebuilding options. Instead, we focus exclusively on adaptive reuse (Marinic, 2026) due to the thoughts below (Bullen, 2007). While an abandoned, purpose-built shopping mall has reached the end of its lifecycle from the functional point of view, sometimes just a couple of decades after opening (Lowry, 1997), the structural component of the building still has plenty of time ahead, oftentimes in the magnitude of many decades. In other words, properties like abandoned malls are simultaneously characterized by a high level of functional and economic obsolescence due to exogenous drivers and a moderate-to-low level of physical deterioration according to age (Shen & Langston, 2010). Therefore, the issue of adaptive reuse potential (Langston et al., 2008) seems worthy of investigation before the building comes to complete depletion. Adaptive reuse is precisely defined as the process of redeveloping and repurposing existing buildings, preserving their structure and fabric while changing their intended use, thus a way – alternative to demolition and rebuilding – to breathe new life into outdated buildings (Hoxha, 2019; Langston et al., 2008). Still, the combination of high functional obsolescence and low physical deterioration poses significant problems and challenges, both financially and in design (Roberts &

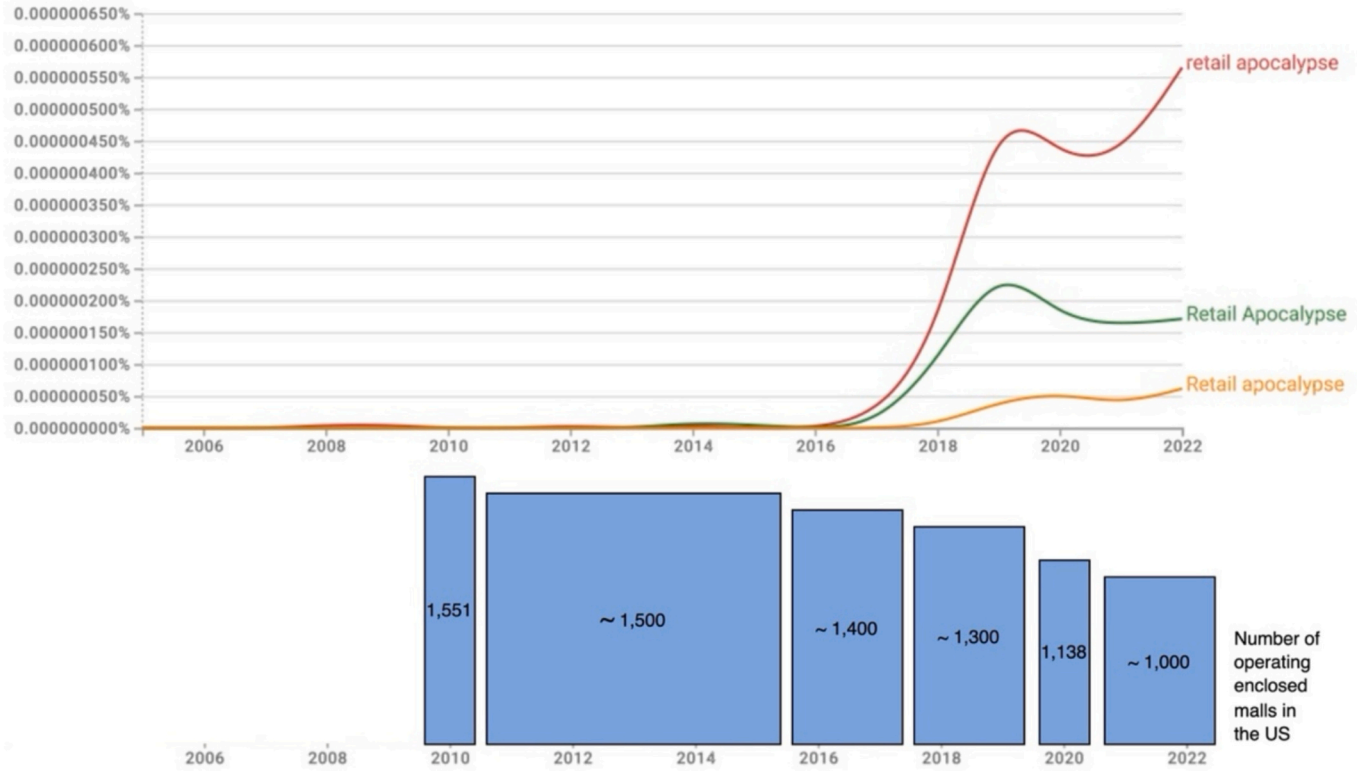

Fig. 1. Retail apocalypse and its trends over the years: top panel, occurrences of the expression in English books (source: Google Books Ngram Viewer, https://books.google.com/ngrams, last accessed 01.02.2025); bottom panel, number of operating enclosed malls in the US (source: authors' study based on (Lin, 2021; Moore et al., 2023; Statista, 2024) and data extracted using the AI tool Microsoft 365 Copilot, last accessed 01.02.2025).

Carter, 2023; Yang et al., 2022).

The remainder of this paper is arranged as follows. Section 2 presents a perusal of the literature on the topic, focusing on the causes of the RA phenomenon and the strategies proposed to avert retail demise. Section 3 explains the four steps of the methodological approach adopted here to deal with the issue of repurposing abandoned shopping malls. Section 4 first shows the results of a survey conducted on abandoned and dying malls in Italy, and then focuses on the selected case study, a somewhat short-lived mall, abandoned after less than fifteen years in business, in a suburban area of the Veneto region, Northeastern Italy. Section 5 presents the results of the analysis, while Section 6 discusses them, emphasizing both the design constraints and the financial issues to address when aiming to rethink dead shopping venues. Finally, Section 7 draws the conclusions.

2. Literature review

The scholarly literature on the topic at hand is relatively sparse, not to mention scattered across a few publication outlets, mainly in marketing science. Below, a perusal of selected pertinent studies – mostly published over the last decade – is presented. The first subsection navigates through the literature that focuses on the exogenous and endogenous causes of what is dubbed RA. The second subsection is meant to discuss the suggestions – even the good practices in some cases – put forward so far to avert the further demise of physical retail stores.

2.1. On the causes of a potential retail apocalypse

The rapid growth of e-commerce and the increased competition from online retailers – but also the rivalry due to the expanding presence of big-box retailers – are often mentioned among the primary causes of the drop in physical retail stores,[4] not to mention retail employment (Burayidi & Yoo, 2021; Chun et al., 2023; Harasta, 2020). Just as the one-stop-shopping experience was at the roots of the success of brick-and-mortar malls (Reimers & Clulow, 2009), the big retailers, both physical and online-based, offer the updated version of such convenience.

The literature also identifies incidental social and economic changes as phenomena likely to have played a role in the RA. The 2008 Great Recession is among them (Harasta, 2020). Closer in time, the Covid-19 pandemic is described as a game-changer in shopping patterns, firstly because of the disruption of long-established supply chains and secondly because of the boost to the so-called omnichannel retailing (Chatterjee et al., 2021). Perhaps the pandemic has promoted a negative attitude toward enclosed malls, which would explain why the presence of other shoppers has been found to correlate with high levels of stress and decreased excitement (Rosenbaum et al., 2021).

Partly unexpectedly, a cause for RA is identified in the managerial misunderstanding of key determinants as far as successful distribution practices are concerned (Ingene & Brown, 2019). A critical factor of a mall's competitiveness is the periodic need for renovation (LeHew & Fairhurst, 2000; Tokosh, 2018). An early study on shopping venues' life cycles shows that renovation may be due in a relatively short time frame after opening, ranging from ten years for downtown malls to twenty years for power centers, up to thirty years for regional malls (Lowry, 1997). Nonetheless, a later study suggests that those time frames may be even shorter (Chebat et al., 2014).

Two studies use principal components, discriminant, and regression analysis to identify the likely key factors of a shopping mall's survival. One of them finds that gross sales are positively correlated with physical and economic size – as represented by mall area and employees, respectively – and negatively affected by socio-demographic factors concerning the market area, such as population change and crime rate (Burayidi & Yoo, 2021). The related predictive model proves effective at distinguishing malls expected to thrive based on sales from those bound to die. The other study identifies the following common features of dead or dying malls: smaller size, fewer people served, and location in low-income market areas (Tokosh, 2018). Overall, those variables are associated with a significant predictive power regarding store occupancy rate and sales.

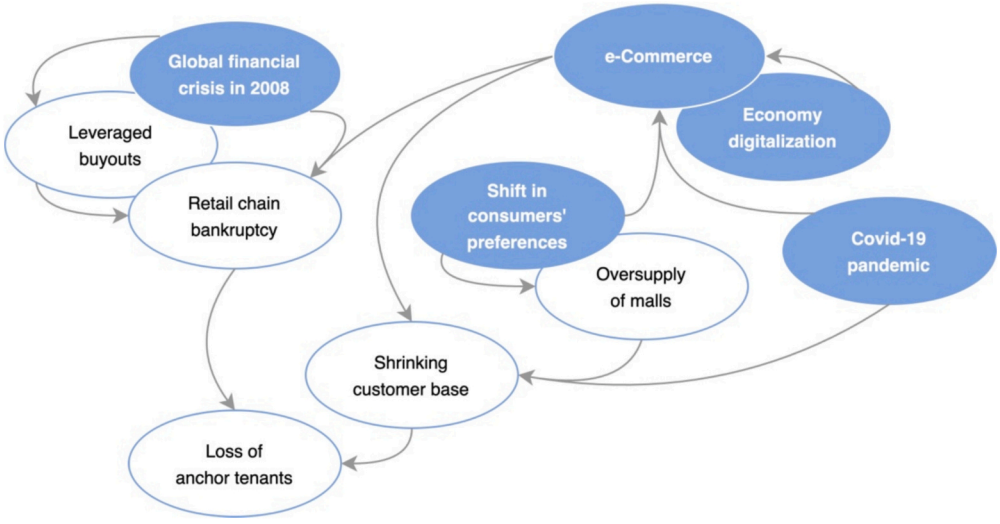

Fig. 2. Underlying causes for the retail apocalypse: an overview.

Several other studies contribute to understanding RA by analyzing stated preferences rather than revealed ones (Ben-Akiva et al., 1994; Johannesson et al., 1998; Shankar et al., 2025). For instance, industry representatives foresee additional e-commerce growth but limited effects on retail space demand (Daniel & Hernandez, 2024), while consumers anticipate the further demise of physical stores (Helm et al., 2020). Regardless, the long-term outcomes are expected to be

[4] Given that the literature sees e-commerce - now - as the root of retail demise, it may be worth noting that the sudden and substantial rise of e-commerce in the 2000s resembles a Black Swan, according to the notion outlined in the namesake book (Taleb, 2010): an unprecedented and unpredictable event that brings massive disruption, yet the occurrence of which lends itself to being rationalized and explained ex-post.

detrimental to retail employees, consumers, and society at large, not to mention the urban environment (Castigliano, 2023; Chun et al., 2023; Helm et al., 2020). Not only surveys (Li et al., 2023; Muposhi et al., 2022) but also the perusal of comments and reviews (Mao, 2022) and longitudinal qualitative analyses (Raffaelli & Noe, 2025) are used to identify adaptation strategies meant to prevent consumers from switching to other retail channels and to counteract the RA phenomenon (Childs et al., 2020; Shankar et al., 2021; Spanke, 2020).

2.2. Re-malling, de-malling, and other strategies to avert retail demise

Since its inception in the mid-1950s – architect V. Gruen is credited for (Gruen & Smith, 1960) – the mall has undergone and is still affected by several transformations involving its size and scale, shape and spatial organization, most favorable location, and eventually even the relationship of competition versus synergy it establishes with other shopping places (Guy, 1998; Rao, 2020). But now there is more to it. Because brick-and-mortar stores are increasingly challenged by the phenomena discussed in the previous subsection, notions such as re-malling and de-malling have begun to make their way through retail studies.

The first term – re-malling – refers to the redevelopment of enclosed malls to counteract the RA phenomenon (Escudero-Gómez & Lois-González, 2025) and increase customer appeal (Feldman, 2004; Tamini, 2018). Mall renovation may include "changes ranging from resurfaced parking spaces, a brand-new facade, redesigned entrances, revamped common areas [...] modernised lighting, improved signage [...], and reorganised store layouts" (Chebat et al., 2014, p. 610). The redevelopment and rebranding of malls are oftentimes incentivized by low occupancy rates and include significant changes in the tenant mix (Guimarães, 2018), as well as the addition of spaces and functions that can be seen as somewhat complementary to retailing, ranging from bar and restaurants – arranged perhaps as a food court – to event, sport, and entertainment venues (Berta et al., 2021).

The second term – de-malling – implies transforming outdated malls into something different and letting them take on new functions (Cavoto & Limonta, 2013). Occasionally, the de-malling process bets again on the retail function: an enclosed mall is transformed into an outdoor shopping center, characterized by fewer stores than before, each one bigger in size. More often, the retail function is replaced by housing, schools and community colleges, civic or cultural or art centers, gyms and sports halls, business centers and coworking spaces, and health facilities, sometimes with mixed uses (Coutinho Guimarães, 2019; Dunham-Jones & Williamson, 2017).

3. Method

In this study, we follow a four-step methodological approach to address the issues in reviving dead malls (Fig. 3).

3.1. First stage: problem identification

The first stage of the analysis hinges on problem identification, meaning that the scholarly literature on the topic and the case studies analyzed therein – although still far from abundant – are used as the primary sources of information. The purpose is twofold. On the one hand, we aim to compile a list of suitable alternatives for former shopping mall spaces, identifying general functions and specific uses – whether private or public, market-based or community-based, profit-oriented or focused on collective benefit – as well as their requirements concerning both location characteristics and building features. On the other hand, we aim to establish the criteria for comparing these alternative uses.

3.2. Second stage: option comparison

The second stage of the analysis focuses on option comparison, where the goal is to rank a set of alternative specific uses from the previous step based on their overall desirability and likelihood of success. The multicriteria decision support tool known as Analytical Hierarchy Process (AHP) (Saaty, 1977) is used to that end. AHP derives a ranking of a set of alternatives, judged on several criteria, by performing a series of pairwise comparisons arranged into square matrices: each alternative against each of the others according to the first criterion, then each alternative against the others according to the second criterion, and so forth until the hierarchy of goals, criteria, and alternatives is completed (Saaty, 1980, 1984).

Let us denote by $\boldsymbol{A} = \{a_{i,j}\}$ a pairwise comparison matrix in which we rate the n alternatives – namely, the potential uses for redeveloping an abandoned mall – according to a given criterion. $\boldsymbol{A}$ is an $n \times n$ square matrix with nonnegative entries, which also satisfies the reciprocal property, thus:

$$a_{i,j} = x_i / x_j \tag{1}$$

$$a_{j,i} = x_j / x_i = 1/(x_i/x_j) = 1/a_{i,j} \tag{2}$$

$$a_{i,i} = x_i / x_i = 1 \tag{3}$$

Building on an early version of AHP (Saaty, 1983), first the nth root of the product of the pairwise comparisons in each row of the matrix $\boldsymbol{A}$ is calculated and then normalized by the sum. The latter provides an approximation of the normalized principal eigenvector, namely, the priority of the alternatives according to the criterion:

$$p_i = \sqrt[n]{\prod_{j=1}^{n} a_{i,j}} \tag{4}$$

$$\widetilde{p}_i = p_i \Big/ \sum_{i=1}^{n} p_i \tag{5}$$

Let us now consider a set of l $n \times n$ square matrices $\boldsymbol{A}_k = \{a_{i,j,k}\}$, meant to accommodate the pairwise comparisons for each of the l criteria. Accordingly, and extending previous Eqs. (4) and (5), the priorities of the alternatives according to the criteria can be expressed as follows:

$$p_{i,k} = \sqrt[n]{\prod_{j=1}^{n} a_{i,j,k}} \tag{6}$$

$$\widetilde{p}_{i,k} = p_{i,k} \Big/ \sum_{i=1}^{n} p_{i,k} \tag{7}$$

Since Eq. (7) provides the local priority for the alternatives, meaning the preference specific to one criterion, the following weighted sum lets us identify the global priority for the alternatives according to all the criteria:

$$\widehat{p}_i = \sum_{k=1}^{l} \left(\widetilde{p}_{i,k} \bullet w_k \right) \tag{8}$$

where w_k represents each criterion's weight.

Here, the pairwise comparisons are expressed as ratios of quantitative data (Stevens, 1946) when available. Accordingly, the eigenvalue of $\boldsymbol{A}$ is equal to n, thus the matrices are always perfectly consistent as the consistency condition is met (Brunelli, 2018). Primary data sources are authors' surveys based on case studies presented in architecture and engineering magazines, and reports published by institutes and agencies such as the World Health Organization (WHO), National Health Service (NHS), Energy Information Administration (EIA), Buildings Performance Institute Europe (BPIE), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), and Institute of Transportation Engineers (ITE). Otherwise, the pairwise comparisons are based on qualitative judgments.

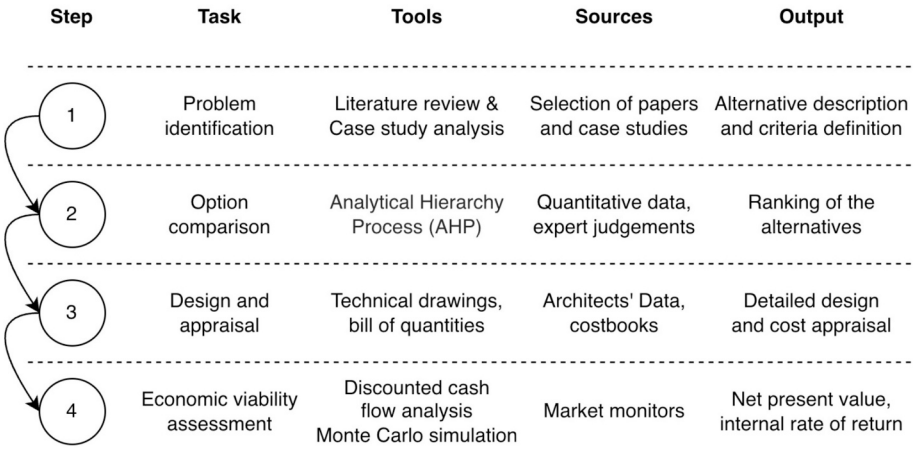

Fig. 3. Methodological approach: analysis workflow diagram.

3.3. Third stage: design and appraisal

The third stage of the analysis hinges on design and appraisal. The purpose is to develop detailed designs for the top three alternatives identified in the previous stage, test their ability to fit into the building, and outline the changes required to the building structure, finishes, and systems to make the new function appealing to prospective users. The primary source is the most well-known reference book for architectural design and space planning (Neufert, 2023).

For cost appraisal purposes, each detailed design is complemented with a summary bill of quantities. The redevelopment cost estimate - thus the capital expenditure (*CapEx*) - is provided through the unit-in-place method (Appraisal Institute, 2013), where the various building components and subcomponents c are identified first, then appropriate quantity measures Q_c are associated with each component and subcomponent, and individual unit costs P_c gathered from the so-called costbooks (Milan Board of Engineers and Architects, 2019) are finally applied to them:

$$CapEx = \sum_{c=1}^{C} (Q_c \times P_c) \tag{9}$$

3.4. Fourth stage: economic viability assessment

The fourth stage of the analysis involves conducting an economic viability assessment, comparing the top three alternatives identified earlier based on their expected economic performance, specifically considering their prospective value and profitability.

The assessment is carried out under the methodological framework of the Discounted Cash Flow (DCF) analysis (Copiello, 2016, 2021; Wyatt, 2013). The International Valuation Standards define DCF as "A financial modelling technique based on explicit assumptions regarding the prospective income of a business or property" (IVSC, 2001, p. 300). Another well-known definition states that within DCF "the value of an asset is the present value of the expected cashflows on the asset, discounted back at a rate that reflects the riskiness of these cashflows" (Damodaran, 2006, p. 696). The notions of discounting and the related concept of present worth can be traced back to the early nineteenth century, with significant contributions from von Böhm-Bawerk (von Böhm-Bawerk, 1903), Marshall (Marshall, 1920), and Fisher (Fisher, 1907, 1930). Building on some pioneering works dating back to the mid-1960s and the early 1970s (Dilmore, 1971; Downs, 1966; Greaves, 1972a, 1972b; Ratcliff, 1972), DCF has long since made its way into real estate appraisal and property valuation, being widely recognized as a primary assessment model within the so-called income approach (French & Gabrielli, 2005, 2018; Kishore, 1996).

Let us denote by CF_t the yearly cash flow, which is the amount of the cash balance for each year t over the useful life T of a mall redevelopment project. CF_t is specifically defined as the sum of capital expenditure ($CapEx_t$), overhead expenses (OH_t), operating expenses ($OpEx_t$), and revenue (Rev_t). The sum of the cash flow figures, once they are appropriately discounted back to the present by the discount rate r, gives the net present value (*NPV*) of that project; while the internal rate of return (*IRR*) represents the specific value of the discount rate r that makes the *NPV* equal to zero. Therefore:

$$CF_t = -CapEx_t - OH_t - OpEx_t + Rev_t \tag{10}$$

$$NPV = \sum_{t=1}^{T} CF_t \Big/ (1+r)^t \tag{11}$$

$$0 = \sum_{t=1}^{T} CF_t \Big/ (1+IRR)^t \tag{12}$$

Here, $CapEx_t$ is estimated according to the method presented in the previous subsection as far as cost of work is concerned, while data sources for OH_t, $OpEx_t$, and Rev_t include real estate market monitors and similar projects when available. Notably, the present value of recurring items, thus the stream of operating expenses and revenue over the project life cycle T is estimated based on the direct capitalization model, thus:

$$-OpEx_0 + Rev_0 = (-OpEx_t + Rev_t) \times \left[(1+r)^T - 1\right] / r \times (1+r)^T \tag{13}$$

The discount rate r and other financial parameters, such as the equity-to-debt ratio, the expected return on equity, and the cost of debt, are estimated based on the data from Damodaran's datasets.[5]

Sensitivity analysis of the DCF model results is performed through the Monte Carlo (MC) simulation method (Jacoboni & Lugli, 1989; James, 1980), which has been extensively used in property investment and valuation (Hoesli et al., 2006; Loizou & French, 2012). In this study, building on similar sensitivity and probability analyses (Copiello et al., 2017; Flanagan et al., 1987; Tian, 2013), point estimates for the most uncertain inputs are complemented by ranges of variation. Then, a hundred thousand iterations of the DCF model are re-run, allowing the parameters to vary within their respective ranges. Finally, frequency distributions of the *NPV* are charted, thereby showing the likelihood that the project will be and remain profitable.

[5] See: https://pages.stern.nyu.edu/~adamodar (last accessed 04.11.2025).

3.5. Value added to the adaptive reuse process

The four-stage method outlined above lends itself to comparison with the typical adaptive reuse process of large commercial assets, which is often a complex, highly collaborative multi-stakeholder workflow. That process can be described as follows. The first step is project inception, when the owner or developer, facing a distressed or underperforming asset, retains consultants to conduct market analyses aimed at identifying economically viable new options (highest-and-best-use screening). The second step hinges on regulatory due diligence, in which planning specialists and attorneys evaluate whether the alternative uses align with the urban plan and existing zoning or require a zoning variance. The third step features architectural and engineering firms conducting physical due diligence to assess the structural integrity of the existing shell, the feasibility of adding new functions (conceptual test-fits), and to provide construction cost estimates. Finally, the fourth step focuses on financial underwriting, with the developer integrating the output from the previous steps into a pro forma analysis, modeling cash flows, and calculating viability criteria to ensure the project meets investors' and lenders' expectations.

The four-stage method adopted here shows several overlaps with the typical four-step adaptive reuse process. The former is not meant as a replacement for the latter, but as an integrated, systematic framework that adds value by addressing two major flaws in the industry workflow. The primary merit lies in breaking down industry silos. While economists advocate for market demand, architects focus on design, and planners prioritize regulatory compliance, multicriteria analysis adds value by providing a mathematical framework to weigh and reconcile competing quantitative and qualitative priorities simultaneously, thereby streamlining early-stage decision-making before significant capital is committed. Another advantage lies in the enhanced approach to risk mitigation. Whereas traditional industry pro formas largely depend on static, single-point estimates for key variables, incorporating simulation analysis into the DCF framework adds value by introducing probabilistic risk models. This provides stakeholders with a far more detailed understanding of the volatility of capital expenditures, financial risk, and the likelihood of achieving target returns.

4. Case study

4.1. Dead and dying malls in Italy

Although the RA phenomenon is relatively new in the US, it has already spread across Western economies. Through a search of public sources accessible via the internet – including national and local newspapers and bulletins, blog posts, company reports, and municipal councils' deliberations – fifty-three abandoned malls, five abandoned outlets, and an additional forty dying malls[6] – where a significant share of the anchor and retail stores are already closed – have been identified (Figs. 4, 5, Tables 1, 2, see also Tables A1-A3 in Supplementary materials, Appendix A). They are primarily located in Northern and Central Italy, the most developed areas of the country, where the construction of shopping malls began first, and where most of them have been built. Notable concentrations of vacant malls can be found in regions such as Lombardy and Lazio; however, the phenomenon involves the whole national territory essentially.

As far as the abandoned malls are concerned, and even though size information is missing for a few of them, the dimensions of the phenomenon are summarized in the following data. Sixteen out of forty-one for which the gross leasable area is known are characterized by a small size (about 39%), between 3400 and 9000 square meters. More than half (around 54%) are in the range of 10,000 to 33,000 square meters. Only the remaining three are larger than 42.000 square meters, with the two largest topping 54,000 and 57,000 square meters, respectively. The average and the median sizes are about 15,700 and 12,900 square meters, respectively.

Concerning the five abandoned outlets, the gross leasable area ranges between 13,000 and 32,000 square meters, with average and median values equal to 22,700 and 24,000 square meters, respectively. Turning to the dying malls, the key figures are as follows: eleven (28%) are characterized by a size between 3400 and 9000 square meters, the other twenty-eight (72%) take on a size in the range of 10,000 to 33,000 square meters, and average and median sizes are both close to 15,750 square meters.

Although being found in several important cities such as Rome, Genoa, Padua, Bologna, and Bari, abandoned and dying malls are mostly located within the administrative boundaries of municipalities that are not provincial capitals (65%), characterized by an average population of just 22 thousand inhabitants, with a maximum population that does not exceed 85 thousand inhabitants. The average distance to the nearest city center is between four and five kilometers for the abandoned and dying malls located in provincial capitals, and approximately 23 km for those located elsewhere, topping a maximum of about 64 km in this case.

Overall, the abandoned malls for which the gross leasable area is known total 642 thousand square meters, and the gross leasable area of the malls in distress sums up to roughly an additional 619 thousand square meters. Considering that the total retail stock in the country – including shopping centers, commercial galleries, retail parks, factory outlets, and entertainment, leisure, and lifestyle centers – is estimated to be near to 20 million square meters,[7] it means that the abandoned malls and outlets account for roughly 4% of it, while the dying malls would add another 3%.

4.2. The former Prisma mall

The case study selected for the analysis is the former Prisma shopping center (see AM31 in Figs. 4, 5, and in Supplementary materials, Appendix A, Table A1) in Porto Viro, a relatively small town of nearly 14 thousand inhabitants in the southeastern part of the Veneto region, northeastern Italy. The town lies 45 km south of Venice, close to the Po River and bordering the environmentally and landscape-sensitive Po Delta Regional Park, a UNESCO Biosphere Reserve.

The idea of building a mall in the area dates back to 1985. The building permit was issued on November 9, 1990, and construction began in 1994 on a 19,550-square-meter plot of land. The mall is arranged into two floors and a total of 45 stores. The ground floor spans 9403 square meters of gross floor area and 5119 square meters of sales space. The whole floor is organized around a central public axis flanked by private shopping areas. A central longitudinal corridor running the entire length of the building establishes a visual relationship from end to end, serves as the internal distribution axis, and provides access to all shops. Two anchor stores are located at the southern and northern ends of the building, featuring a grocery store and a beauty and home care store, respectively, until the mall went out of business. The other shop units have varying areas: smaller on the front, larger on the back. Their layout is modular, enabling subdivisions according to different tenant needs. Service areas, technical rooms, and storage spaces are arranged

[6] Here we adopt the following definitions. An abandoned mall is an indoor shopping center in which all retail units are closed, and a partial or full reopening is not expected in the foreseeable future. A dying mall is an indoor shopping center in which a substantial share of retail units (more than one-third) is closed, and the property struggles to attract new tenants. An abandoned outlet is an outdoor shopping center in which all the retail units – originally intended for brand-name companies to sell their products directly to consumers – are now closed.

[7] According to a 2025 report by Jones Lang Lasalle, see: https://www.assoimmobiliare.it/wp-content/uploads/2025/02/jll-italy-retail-market-dynamics-q4-2024.pdf (last accessed: 20.10.2025).

Fig. 4. Dead and dying malls in Italy as of early 2025 (sources: authors' study, Google Earth).

behind the rear façades, segregating public circulation from logistics. Two double-height voids at the center of the building define the vertical connection core, housing a staircase, an elevator, and an escalator. The first floor includes an additional 3720 square meters of gross floor area, equaling 2756 square meters of sales space, and approximately 5700 square meters of parking area accessible via a ramp. Overall, the building's spatial configuration follows a repetitive system that provides flexibility of use and efficient circulation, with clearly distinguished functional hierarchies.

The main façade features a prism-shaped primary entrance, from which the mall also derives its name, acting as a visual and functional landmark (Fig. 6) and facing the ground-floor parking and the national road serving the facility. Concrete panels, metal covering, and horizontal ribbon windows characterize the rest of the façade. Other entrance points are distributed along the building's perimeter, allowing access from the outside directly to some commercial units. Secondary entrances are also to be found on the upper parking level. The simplicity of the façade and the regularity of the openings mirror the modular logic of the internal distribution and the functional character of the complex.

The building's load-bearing structure is composed of both vibrated reinforced concrete and prestressed concrete elements. The foundation system includes cast-in-place piles topped by reinforced concrete footings, which are designed to accommodate precast reinforced concrete columns with socket dimensions of 60 and 90 cm. Prestressed reinforced concrete beams with a reinforced concrete topping, acting as a structural diaphragm, shape the floor slabs. The roof structure consists of bidirectional prestressed concrete elements. The external envelope is made of prefabricated sandwich panels, 30 cm thick, with 10 cm of expanded polystyrene insulation. Some structural figures are as follows: footprint is 202 by 72 m; maximum height is 8 m; beams are supported by 143 pillars; maximum beam span is 11 m; maximum beam length is 18 m; the roof structure withstands a live load of 500 kg per square meter.

Opened in 1995, the mall was sold to a new owner in 2006. It went out of business around late 2012 and early 2013, except for the anchor store located at the northern end of the building, namely, the beauty and home care store, which remained operational until late 2021. The building was seized in 2013 due to the owner's outstanding debts. An appraisal drafted in 2016 set the property's market value at about €2.6 M. Between late 2018 and early 2022, several auctions of the former Prisma mall were held, with starting prices progressively decreasing from €1.4 M to €0.3 M, and minimum bids shrinking from €1.1 M to €0.25 M (Fig. 7). Finally, a group of local entrepreneurs bought the

Fig. 5. Aerial views of selected dead malls in Italy (source: Google Earth).

Table 1
Summary data on the Gross Leasable Area (GLA, in square meters).

	Minimum	*Maximum*	*Average*	*Standard deviation*
Abandoned malls	3,400	57,100	15,676	12,354
Dying malls	3,700	36,945	15,863	8,723
Abandoned outlets	13,000	32,000	22,709	6,688

Table 2
Summary data on the time windows.

	Opened	*Closed*	*Years in activity*
Abandoned malls	1979–2009	2008–2021	1–26
Dying malls	1988–2003	–	–
Abandoned outlets	2011–2017	2013–2020	2–7

property for €300 thousand.

The sharp contraction in market value highlights a core principle of urban land economics: the fundamental distinction between unimproved capital – namely, the underlying land value – and improved capital – that is, the value embodied in the physical structure – under conditions of acute economic and functional obsolescence (Mansfield & Pinder, 2008). In a functioning commercial property, market value reflects both components. However, when a structural demand shock hits a specialized asset such as the Prisma shopping mall, the value of its improved capital can rapidly evaporate. Because the built structure is fixed in space and functionally tailored to retail, its withdrawal from the market drives the value of the physical structure close to zero, or even turns it into a net liability due to conversion costs. Consequently, the €0.3 M auction acquisition price serves as a market floor that approximates the unimproved capital, that is, the baseline underlying land value.

The reasons for selecting this case study are based on both location and building features. As for the area, the former Prisma mall is located outside a provincial capital and is farther away than the average distance mentioned in the previous section. Additionally, the population within a 20-km radius hardly exceeds 90 thousand inhabitants, and the main town in the area already has an enclosed shopping center. Therefore, the demand for a mall is at best weak, calling for a redevelopment project with new uses. Concerning the building, the construction dates back only three decades. Accordingly, its residual life, not to mention the residual value, suggests that demolition and rebuilding may prove unprofitable. Therefore, the fitting of new uses into the existing structure should be pursued.

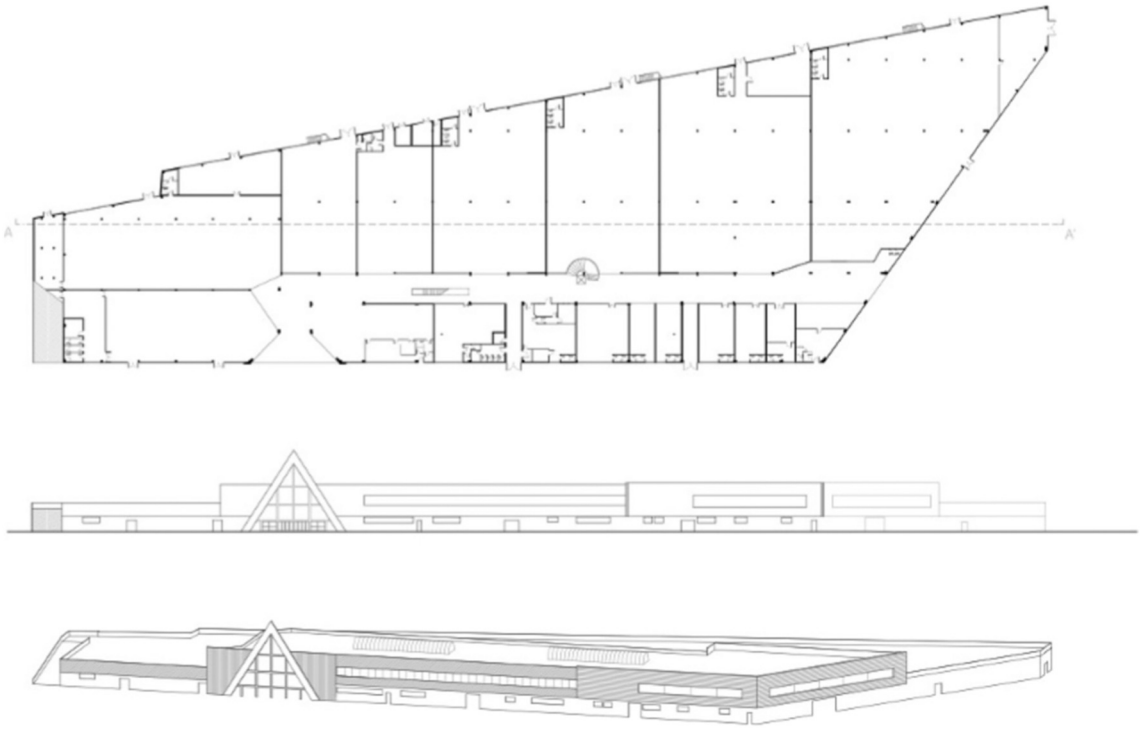

Fig. 6. Ground floor layout, front view, and axonometric view of the former Prisma mall (source: authors' study based on documents annexed to the seizure of property procedure).

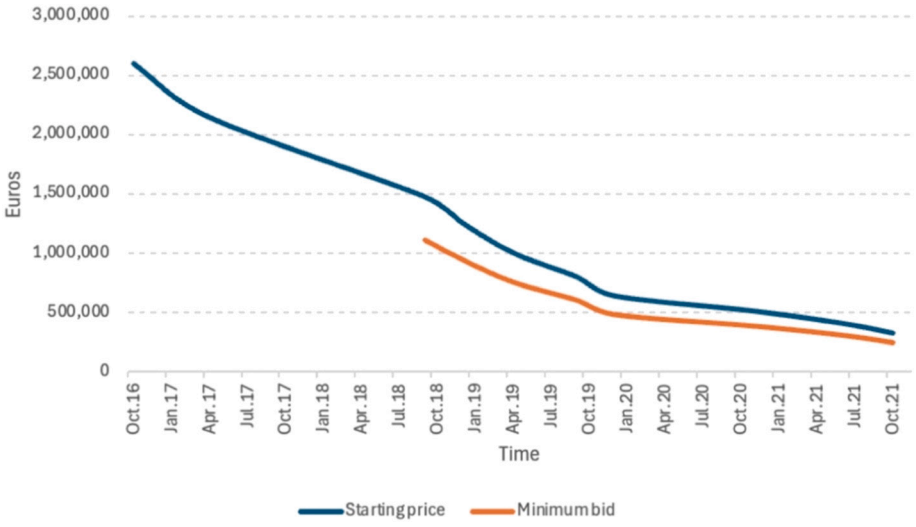

Fig. 7. Starting prices and minimum bids in the auctions of the former Prisma mall.

5. Results

5.1. First stage: alternative description and criteria definition

Building on the literature referenced in Section 2 and more (Dunham-Jones & Williamson, 2011; Williamson & Dunham-Jones, 2021), as well as the case studies analyzed therein (see Supplementary materials, Appendix B, Table B1), nine general functions and twenty-eight specific uses suitable for the purpose of redeveloping an abandoned mall are identified (see Supplementary materials, Appendix B, Table B2 for the complete list). For each potential use, the requirements related to location – such as accessibility, proximity to other facilities, and availability of public transport options – and to building – namely, dedicated areas for specific uses, their minimum square footage and ceiling height, and essential features and systems – are also listed. Based on the requirements met by the former Prisma mall, nine alternatives are found suitable for its redevelopment. In summary, they are as follows (Table 3): a_1) senior housing; a_2) co-working; a_3) fulfillment center; a_4) data center; a_5) medical facility; a_6) fitness center; a_7) sports hall; a_8) play hall; a_9) cultural center.

The perusal of the same literature listed in Section 2 leads to the selection and definition of ten criteria encompassing physical and functional aspects in the reuse of the building, social and environmental externalities, and investment-related aspects spanning from cost-effectiveness to timeliness. In summary, the criteria are as follows:

Table 3
Alternative description.

ID	Specific use	Location requirement	Building requirement
Function: accommodation			
a_1	Senior housing	Proximity to essential and healthcare services; parking; amenities / public transport	Studio: 28–30 m2 (one person), 35–40 m2 (two people); one-bedroom flat: 40–60 m2; two-bedroom flat: 60–70 m2; common areas; shared kitchen or dining area; nursing station
Function: workspace			
a_2	Co-working	Near city center or business district; parking; public transport	Minimum 10 m2 per worker; ceiling height: 3 m for open spaces and large offices
Function: production and storage			
a_3	Fulfillment center	Accessible to heavy vehicles; proximity to logistic hubs; close to key target markets	Goods receiving and sorting area; separate storage area; clear height: 7–12 m; loading ramps and unloading docks
a_4	Data center	Reliable energy and data supply network; far from natural hazards; limited accessibility for security	Area up to 1000 m2 (on-premises data center, colocation data center), 10,000 m2 (edge data center), or 100,000 m2 (hyperscale data center); access control; temperature and humidity control
Function: health			
a_5	Medical facility	Proximity to hospitals or clinics; parking for staff, patients, and visitors; full accessibility	Waiting room(s); general examination room(s); specialist consultation room (s); diagnostic room(s); laboratory exam room(s); restrooms
Function: wellness and sport			
a_6	Fitness center	Near residences, offices, schools; in high pedestrian and vehicular traffic areas; complementary services	Equipment area; weight room; areas for specific activities; changing rooms; additional services such as spa, wellness, and shop within the facility
a_7	Sport hall	Wide public accessibility; close to densely populated neighborhoods; ample parking	1000–10,000 m2 depending on capacity and sport; 50–100 seats minimum; 7–12 m minimum height depending on sport; complementary spaces; cafeteria/refreshment area
Function: entertainment			
a_8	Play hall	Easy access via major roads; ample parking	1000–3000 m2 with 6 m minimum height depending on activities (softair, paintball, trampolines, etc.); dining areas: restaurants, bars, snack stands, rest areas, changing rooms and lockers, first aid
Function: community space			
a_9	Cultural center	Accessible central location, close to complementary services	Exhibition and event areas; meeting rooms for workshops

- c_1) space efficiency, which assesses the ratio of utilized area to total plot area based on case studies of similar buildings;
- c_2) fitting into the facility layout, aiming to quantify the adaptability of the proposed use to the existing building structure using the average, weighted by cost significance, of modification scores for load-bearing elements, perimeter walls, and roof;
- c_3) space flexibility, which accounts for functional adaptability, with modular, highly scalable, open spaces that score higher, while rigid or specialized layouts score lower;
- c_4) community benefits, for which alternatives offering essential public services, health, and cultural activities score higher, while alternatives characterized by limited community engagement score lower;
- c_5) urban load, providing proxy quantification of resource demand and environmental impact, by primarily focusing on annual energy consumption;
- c_6) traffic load, quantifying traffic induced by each potential use based on typical occupancy rates and use patterns;
- c_7) land take, which aims at assessing permeable surface retention based on benchmarking against case studies with similar characteristics;
- c_8) upfront cost, considering the initial financial outlay for implementation;
- c_9) investment risk, focusing on the risk profile of the investment for the prospective developer;
- c_{10}) timespan, measuring project length in months based on the expected duration for design and execution.

All the criteria except two – c_3 and c_4, which are qualitative in nature – are quantitative, with an objective function defined as the maximization or minimization of proper measures or ratios (Table 4).

5.2. Second stage: ranking of the alternatives

The nine alternative potential uses (Table 3) are pairwise compared using the AHP methodology against the ten identified criteria (Table 4). Below are the considerations driving the multicriteria analysis (see Supplementary materials, Appendix C, Tables C1-C4).

The criteria weighting system is also derived based on the AHP methodology. The pairwise comparison of the criteria is intended to mimic the behavior of a stakeholder concerned with minimizing market exposure and de-risking the redevelopment; thus, risk aversion takes precedence over capital expenditure, which in turn takes precedence over development speed (high weight on the criterion c_9, investment risk; moderate weight on c_8, upfront costs; low weight on c_{10}, timespan). The same stakeholder is also efficiency-tilted, meaning a focus on maximizing usable area and functional throughput, even if this entails a willingness to sacrifice future adaptability. In a nutshell, the criteria weighting system favors the so-called safe bets. Accordingly, options characterized by full use of the leasable area, established tenants, and a guaranteed return are expected to score higher than experimental options, even if the latter are more flexible, cheaper, or faster to build (high weight on the criterion c_1, space efficiency; moderate weight on c_2, fitting into the facility layout; low weight on c_3, space flexibility).

Furthermore, the success factors concerning the social acceptability of the redevelopment are identified as middle-tier criteria. Therefore, a non-negligible weight is given to externalities, both positive and negative, as represented by community benefits on the one hand, and traffic load, land take, and urban load on the other. Especially, transport impact, including access performance, and community perception are identified as pivotal social aspects, while land take and generalized urban pressure matter but are less critical (moderately high weight on the criteria c_6, traffic load, and c_4, community benefits; moderately low weight on c_7, land take, and c_5, urban load).

The data center turns out to be the best alternative by far. That is due to a moderate investment risk, considerably lower than that characterizing the options belonging to the wellness, sport, and entertainment functions. Most importantly, the data center, similarly to the fulfillment center, is expected to fit easily into the facility layout (Figs. 8, 9). Also, it is heavily valued for its very low – edging in irrelevance – traffic load, countered in terms of urban load, especially as far as energy consumption is concerned.

The second- and third-best options are found in the senior housing and the medical facility, respectively. They are both characterized by a relatively low investment risk and similar judgments concerning space efficiency, the ability to fit into the facility layout, and the expected community benefits. On the contrary, they differ significantly in terms of

Table 4
Criteria definition.

ID	Criterion	Description	Metric and objective function	Data source
c_1	Space efficiency	Ability of the proposed use, based on a realistically scaled program, to achieve complete and efficient occupation of the entire available area	Maximization of the ratio of used area / plot area	Survey based on case studies presented in architecture and engineering magazines
c_2	Fitting into the facility layout	Ability of the proposed use to adapt to the structural and spatial configuration of the existing building, ensuring optimal exploitation of its remaining service life	Minimization of the ratio of modified area / built area (based on the structural elements of the building)	Survey based on case studies presented in architecture and engineering magazines and costbooks
c_3	Space flexibility	Ability of the intervention to be easily adaptable to various uses or to allow for potential expansion of the proposed uses	Qualitative judgment	Authors' survey
c_4	Community benefits	Ability of the proposed use to meet the needs of as many direct and indirect users as possible	Qualitative judgment	Authors' survey
c_5	Urban load	Prospected demand for resources, especially energy, in the neighboring areas	Minimization of the energy requirement	Reports published by WHO, NHS, EIA, BPIE, ASHRAE, ITE
c_6	Traffic load	Prospected additional volume of movement on the adjacent national road due to the proposed use	Minimization of the additional volume of movement	Reports published by WHO, NHS, EIA, BPIE, ASHRAE, ITE
c_7	Land take	Ability of the proposed use to reduce land take and soil sealing, through selective demolition and the adoption of architectural mitigation strategies	Maximization of the ratio of permeable area / plot area	Survey based on case studies presented in architecture and engineering magazines
c_8	Upfront costs	Expected upfront costs for the implementation	Minimization of upfront costs	Costbooks
c_9	Investment risk	Ability of the proposed use to lower the overall risk related to the investment	Minimization of the investment risk (based on betas by sector)	Betas by sector in Europe (Damodaran's dataset)
c_{10}	Timespan	Expected duration for the design and implementation	Minimization of project duration	Costbooks

negative externalities, with the latter alternative being worse in terms of resource demand and traffic, and thus subject to greater urban and traffic loads.

A brief digression is in order here about planning permission for a change of use. According to the town plan and the local zoning, the former Prisma mall belongs to an industrial and commercial expansion area, for which the primary permitted land uses are as follows: commercial (retail, offices), industrial and manufacturing (factories and warehouses), and entertainment and health (sports complexes, laboratories, and clinics). Therefore, while the data center and the medical facility already comply with zoning regulations, the senior housing requires a planning variance, which may result in a delayed approval and, thus, a longer timeframe.

5.3. Third stage: detailed design and cost appraisal

Detailed projects for the three top-ranking alternatives have been drafted to assess the functions' actual adaptability to the case study building (see Supplementary materials, Appendix D, Fig. D1, Appendix E, Figs. E1-E2, Appendix F, Figs. F1-F2 for the ground floor plans, front views, and sections).

The data center is the easiest to fit into the existing building. The existing structure can readily accommodate four 536-square-meter blocks, each consisting of 96 server-hosting racks. Because of the abandoned mall's irregular shape, far less of the available square footage is used, yet the data center remains sizable. The unexploited built area could host a fifth block of racks or, alternatively, other compatible functions. Refurbishment activities are limited to demolition work, structural reinforcement, waterproofing, flooring and wall cladding, window and door replacement, and installation of a few systems. Other systems and related equipment – such as electrical and power distribution, cooling – are integrated with the blocks that host the racks.

The senior housing function comprises 46 dwellings covering 3677 square meters of gross floor area; 25 flats are intended for one person, and the remaining 21 for two people. An additional 5211 square meters of gross floor area accommodate common areas and ancillary spaces, including the reception, cafeteria, and reading room. The refurbishment work begins with the demolition of a section of the building and some slabs to create inner courtyards. Then, renovation work includes structural reinforcement, screeds and subfloors, waterproofing, and insulation. The construction of dwellings and common areas in the former mall requires performing brickwork, plastering, drywall, and flooring operations. New systems must be provided, including heating and air-conditioning, plumbing, fire suppression, and lifting. Given the building's unusual height for residential construction, suspended ceilings are designed to accommodate several systems. Landscaping is the last work to be carried out for both the inner courtyards and for each flat on the ground floor, which has a loggia facing a small private garden.

The medical facility is organized in a way that it can host nine wards, each with two medical offices and related common areas, spreading over a total of 10,749 square meters. The renovation entails substantial work on the former mall, including demolition and structural reinforcement, brickwork, plastering, and flooring operations, as well as the installation of new dry walls, operable walls, and suspended ceilings. A new heating, ventilation, and air conditioning system must be provided, along with plumbing, fire suppression, and lifting systems.

Because of the varying intensity of renovation work, cost appraisal leads to different estimates: as low as only €110 per square meter for the data center, up to nearly €1400 per square meter for the senior housing option, and as high as almost €2.100 per square meter for the medical facility solution. Also, the above unit costs apply to different floor areas (Table 5).

5.4. Fourth stage: economic viability assessment

The DCF model is arranged into three parts (Table 6). The first recaps

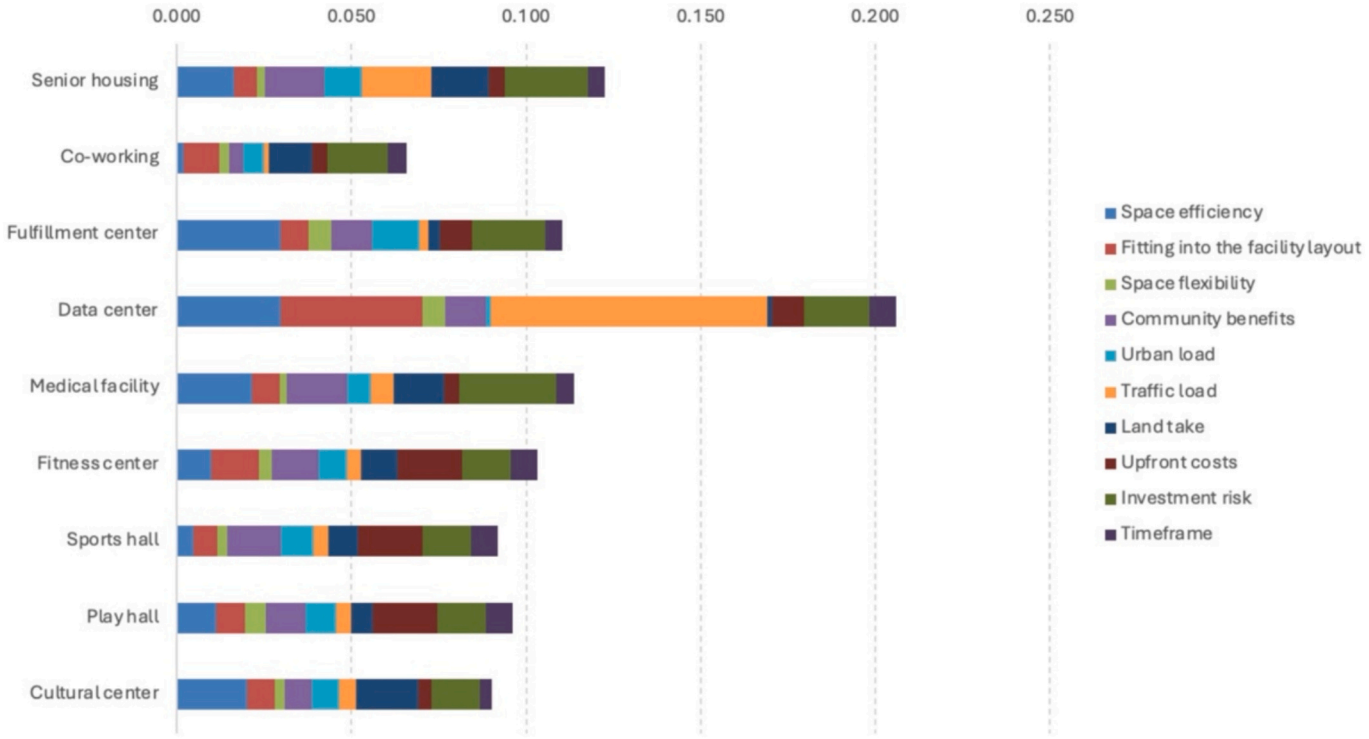

Fig. 8. Evaluation of the alternatives by criteria.

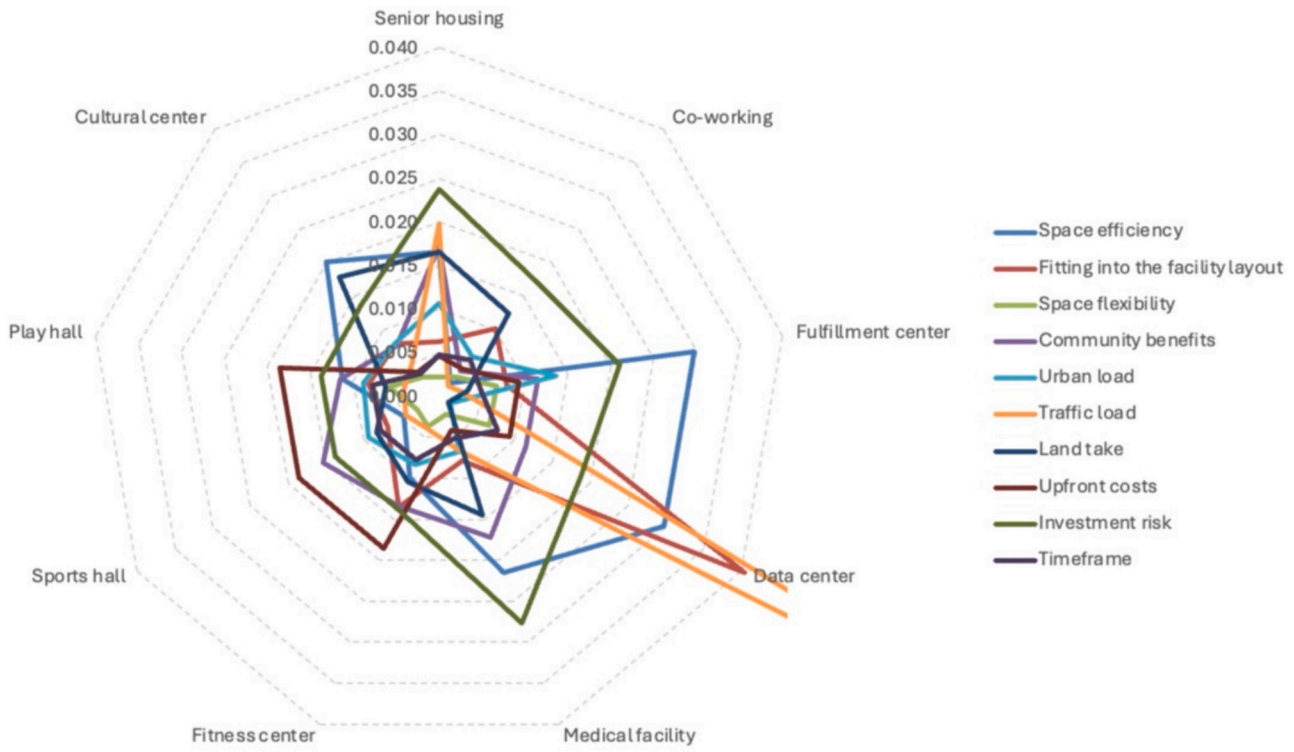

Fig. 9. Multidimensional representation of the preferences for the alternatives.

the estimates of the following items: capital expenditure, namely, the cost of work and the additional expenses for furniture and fixtures; overhead expenses, including design and planning fees; operating expenses, which refer to operations and maintenance costs; and finally, revenue. The second section features the estimates and assumptions concerning the parameters needed to perform discounting: timeframe, including the estimated time of completion and the expected useful life; sources of finance, meaning the share of equity and debt, and cost of capital, namely, all the rates that enter the calculation of the weighted average cost of capital and, net of inflation, of the discount rate. The third and final part shows the calculations of the evaluation criteria: net present value and internal rate of return, respectively.

Table 5
Cost appraisal.

Category of works	Data center		Senior housing		Medical facility	
	Ref.	U. cost	Ref.	U. cost	Ref.	U. cost
		€/m2		€/m2		€/m2
Demolition work	D21b	6.8	D21a	28.8	D15	133.2
Structural reinforcement	D15	44.7	D15	44.7	D15	192.5
Masonry and brickwork			D27	22.4	D15	102.5
Plastering			D27	17.7	D15	37.4
Screeds and subfloors			D27	42.5	D27	42.5
Waterproofing	D21a	8.0	D27	48.3	D27	48.3
Drywall and suspended ceilings			D27	119.7	D15	99.9
Operable walls					D15	159.9
Flooring	E8	29.0	D27	84.6	D15	138.3
Wall cladding	D21b	13.2			D15	50.6
Windows and doors (frames)	E8	3.9	D27	42.6	D15	27.1
Curtain walls and insulation			D21b/c	238.4	D21b/c	238.4
Metalwork			D27	23.1	D15	24.1
Carpentry					D15	10.2
Painting			D27	18.7	D15	11.6
Mechanical systems*	E8	4.3	D15/21a	203.2	D27	321.4
Electrical system			D15	241.6	D15	241.6
Lifting system			D27	38.1	D27	38.1
Supporting works/services			D15	66.9	D15	66.9
Landscaping			I10	113.6	I10	99.0
Unit cost (€/m2)		110		1,395		2,084
Floor area (m2)		13,163		8,888		10,749
Total cost (€)		1,446,614		12,397,871		22,395,542

* Heating, air-conditioning, plumbing, sanitary water network, and fire suppression systems.

Table 6
Economic viability assessment.

		Data center	Senior housing	Medical facility
Capital expenditure				
Construction	€	1,446,614	12,397,871	22,395,542
Furniture and fixtures	€	24,456,981	482,400	2,940,201
Overhead expenses				
Design fees	€	115,729	991,830	1,632,964
Planning fees	€	131,235	516,109	2,688,002
Operating expenses				
Operations	€/y	2,987,200	373,357	24,050,888
Maintenance	€/y	129,518	64,401	1,266,787
Revenue				
Rent	€/y	5,203,320	1,289,778	26,872,500
Timeframe				
Estimated time of completion	y	1	2	2
Useful life	y	45	45	45
Sources of finance				
Equity	pct.	40%	30%	40%
Debt	pct.	60%	70%	60%
Cost of capital				
Risk free rate	pct.	4.50%	4.50%	4.50%
Risk premium rate	pct.	5.50%	5.50%	5.50%
Beta		0.90	0.71	0.61
Cost of equity	pct.	9.45%	8.41%	7.86%
Cost of debt	pct.	4.80%	4.80%	4.80%
Weighted average cost of capital	pct.	6.66%	5.88%	6.02%
Inflation	pct.	2.05%	2.05%	2.05%
Discount rate	pct.	4.52%	3.75%	3.89%
Evaluation criteria				
Net present value	€	12,848,616	3,393,810	2,221,219
Internal rate of return	pct.	7.7%	5.3%	4.4%

The data center option has the highest upfront costs, not because of building refurbishment, as most of these costs go into installing the blocks with racks and servers, along with the related electrical and cooling systems. Despite the significant investment, the data center is also characterized by the highest NPV (€12.8 M) and IRR (7.7%), driven by strong prospective revenue and a large operating margin. The senior housing option shows a positive NPV (€3.4 M) and an IRR (5.3%) slightly above the discount rate, thus can be described as conditionally profitable. Specifically, economic viability hinges on several assumptions that must be met, such as full occupancy, substantial revenue from renting the dwellings and providing hotel-like services, and strict control over operating costs. In addition, because senior housing requires a zoning variance, which can be obtained through an agreement between the private landowner and the local public planning authority, a land value recapture mechanism comes into play. In the case of a public-private agreement for a zoning variance, national legislation mandates that at least half of the added property value be returned to the community. The medical facility is economically less viable than the other alternatives as it has the lowest NPV (€2.2 M), and an IRR (4.4%) that is edging the discount rate. The poor economic performance of this option is due to a combination of high investment costs and low operating margins. Specifically, the operating expense-to-revenue percentage ratio is in the high double digits, leaving little room to repay such a significant investment.

6. Discussion

6.1. Design constraints

The architectural design process highlights several constraints related to the following building elements: shape and size, foundations as well as load-bearing floors and roofs, pillars and beams, facades, and entrances. The constraints affect the three options studied here to varying degrees.

The irregular layout of the former mall does not pose a limitation for the data center, as its box-in-box typology makes it almost independent of the existing envelope. On the contrary, the senior housing and medical facility options require both to regularize the shape – by introducing internal courtyards, eliminating blind corners, and creating cuts and voids, so to bring light and air to the center of the building – and reducing the size – by selectively demolishing the largest spaces of the building, so as to ensure natural illumination and ventilation.

While the load-bearing floors and roofs do not pose significant limitations to selective demolition and removal work, except for some slabs

that are difficult to remove, the layout of pillars and beams further complicates the issue. In the data center, pillars interfere with the positioning and alignment of racks within the blocks. In the senior housing and medical facility, the removal of the floor to create the courtyards is constrained by the position of pillars and reinforced concrete footings and must maintain a safe distance from them. Also, rooms and hallways must adapt to the pillar grid, which has unintended consequences, resulting in some of them having unusual widths.

Finally, the prefabricated façade needs to be demolished and replaced with a new one that includes several openings in the senior housing and medical facility cases. The main entrance, leading to the reception, must be complemented with secondary access points and emergency exits, paired with the reorganization of internal flows. In addition, windows and loggias must be provided for each dwelling.

6.2. Financial burdens

Although each option turns out to be feasible from a financial perspective, there is more to consider as far as the economic viability judgment is concerned, with the primary issue being uncertainty.

The three alternatives are expected to remain profitable unless the discount rate exceeds a given threshold (Fig. 10). At an estimated discount rate range of 6.5% to 7.5%, the senior housing and medical facility options would be characterized by a negative NPV. At an estimated discount rate of about 8%, none of the options would be economically viable. Potential changes in the discount rate also affect the ranking of the alternatives. Incidentally, when the discount rate falls below 3.5%, the medical facility outperforms the senior housing. More importantly, for the discount rates used in the DCF valuation – namely, in the range of 3.7 to 4.5% – the data center option maximizes value generation; conversely, for a discount rate above 10%, the senior housing option minimizes losses.

The uncertainty issue is further evident when considering the potential variability in NPV from changes in inputs. For each option, some basic data used to estimate cash inflows are identified as the most difficult to predict: the server yield in the data center (assumed at about €11,500 per year for each rack, but with a huge variability that sources set in the range of €10,000–30,000 per year); the rent for housing services, additional to the base monthly rent, in the senior housing option (assumed equal to €1400 per month for a standard dwelling of 65 square meters, with sources pointing at a range between €800 and €2000 per month); the income for the provision of user services in the case of the medical facility (assumed at €2500 per square meter a year, which is halfway in the range of €1800 to €3200 per square meter a year according to sources). The potential variability in the above-mentioned parameters makes the revenue estimates characterized by a non-negligible degree of vagueness. By letting them vary into those intervals, the impact on economic viability can be accounted for (Fig. 11). The NPV of the data center option is seen to vary between -€31.5 M and €57 M. The overall probability of being above zero is 75%. The NPV of the senior housing alternative is instead characterized by a much narrower range of -€1.5 M to €8.3 M. Interestingly, the overall probability of being above zero is higher, topping 85%. Finally, the NPV of the medical facility option shows a considerably wider variation range, with a nearly 50:50 probability of taking on a negative or positive sign.

When considering the economic feasibility of repurposing an abandoned shopping mall, one last aspect should not be missing. The NPV of the three alternatives considered here (from €2.2 M to €12.8 M) is several times greater than the price ultimately paid to buy the property (barely €0.3 M), leaving enough room for considerable developer's profit. Nevertheless, that is only because the property in question was seized and repeatedly listed for sale at lower and lower prices each time, ultimately flooring at the mere value of the unimproved capital. The property market value – as estimated at the time of initial seizure (about €2.6 M) – is consistent only with the NPV of the data center, whereas the options of senior housing and medical facility make no economic sense for a rational developer. Therefore, the possibility of repurposing a dead mall is heavily constrained by the book value of the property as is, limiting the range of redevelopment alternatives, unless the former owner is willing to accept a sizable asset-value loss. In other words, the financial feasibility of any proposed conversion hinges entirely on whether the newly introduced improved capital can generate an investment yield that justifies reclaiming over redevelopment.

7. Conclusions, policy implications, and further developments

A considerable and growing number of large-scale commercial facilities built just a few decades ago are now in decline. The trend is bound to end in their decommissioning and subsequent abandonment, posing a significant issue for private stakeholders, planning authorities, and communities at large, as it can also trigger the degradation of surrounding areas. What should be done with those buildings that dot urban and, more often, suburban landscapes? What forms of adaptive reuse can be envisioned? Cases and examples of adaptive reuse stretch back in time across Europe: from the Roman amphitheater of Arles, transformed into a fortified citadel during the Middle Ages, to the Mosque of Córdoba, later converted into a cathedral, to more recent instances in which convents and monasteries now host public offices, schools, and university campuses. These examples suggest that viable forms of adaptive reuse are closely tied to the original structural and

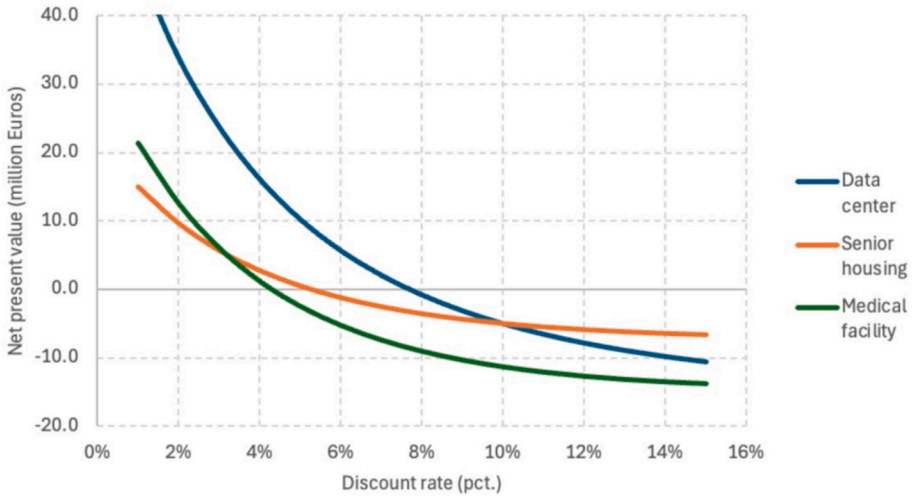

Fig. 10. Net Present Value trend as a function of the discount rate.

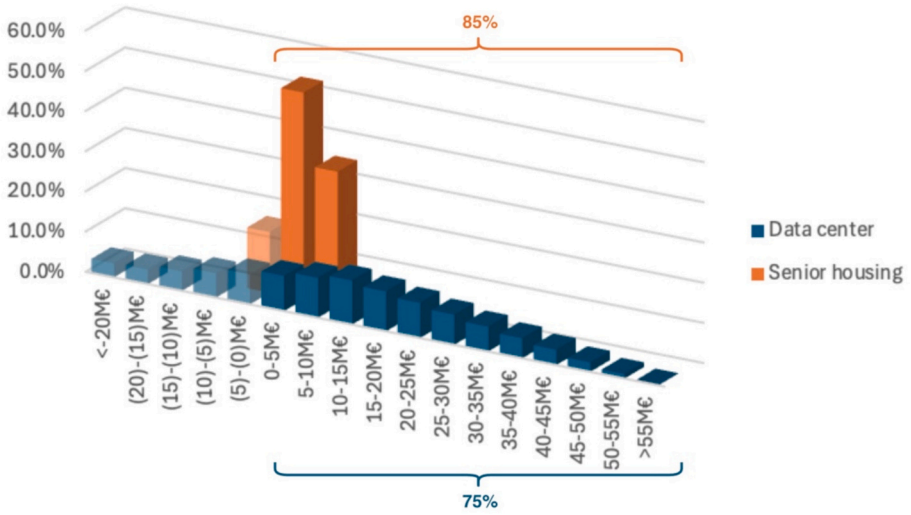

Fig. 11. Net Present Value as a function of changes in the revenue parameters.

architectural configuration and depend on its ability to accommodate specific functions. Because of a lack of historical or architectural value, large structural spans, and unrestricted spatial flexibility, most dead shopping malls offer a wide range of options for adaptive reuse projects.

This study addresses the redevelopment of abandoned shopping malls in the broader context of the RA, seen not merely as a transient market fluctuation but as a structural transformation of the retail industry, driven by technological changes and shifts in consumers' preferences and behaviors. Here, we examine the RA phenomenon through the lens of the Italian context and focus on the adaptive reuse of an abandoned brick-and-mortar mall rather than on demolition-and-rebuild alternatives. Accordingly, the research question we seek to answer can be summarized as follows: how can a dead shopping center be brought back to productive use, given that the hosting building exhibits the coexistence of high functional obsolescence, relatively modest physical deterioration, and long residual structural life? To address the above research question, a replicable four-stage, mixed-methods approach is formalized and tested. The methodological architecture hinges on: identification of candidate post-retail functions and decision criteria based on literature perusal, multi-criteria evaluation based on AHP to operationalize the comparison and ranking of post-retail functions, concept-level design to check fitting ability into the existing building and deliver cost appraisal, economic viability assessment based on DCF analysis and MC simulation to measure profitability and success probability.

On the one hand, the design stage has the merit of exposing option-specific constraints concerning, for instance, the shape and size of the abandoned shopping mall, with selective demolitions required to regularize depth and geometry as well as to restore daylighting and natural ventilation. The structural grid of pillars and beams is another source of design constraints, with the need to adapt the interior layout, possibly accepting compromises as far as positioning, arrangement, and size of private and common areas are concerned. In summary, while the adaptive reuse of abandoned shopping malls is technically achievable, the required building work to accommodate certain functions is extensive. On the other hand, the economic valuation stage and related sensitivity analysis highlight potential sources of uncertainty, such as the macroeconomic environment, with discount rate drifts able to significantly change the ranking of the alternative according to their NPV, and revenue-side fundamentals, with the possibility that one option shows the highest NPV and another is characterized by the highest probability of a positive NPV, cautioning that economic viability parameters should be interpreted together with robustness and dispersion metrics. Furthermore, when some reuse alternatives are benchmarked against the property's book value, they fail to generate sufficient cash flows to justify acquisition by a rational developer, suggesting that book value may represent a systemic barrier to repurposing, rendering several options infeasible unless a drastic write-down of the asset's value is undertaken.

The implications of the above findings extend to real estate developers, as well as to urban planners and policymakers. Developers are suggested to consider that industrial and logistical conversions may offer a path of least resistance, both in terms of physical compatibility and financial return. Urban planners and policymakers should be aware that, when the goal is to transform dead malls into community assets, the market mechanism alone may be insufficient. Policy recommendations imply providing direct and indirect financial support for community-preferred options that yield external benefits, with direct support potentially including rebates on planning fees if not public capital grants, while indirect support possibly features zoning variances intended to increase market appeal.

This study lays the groundwork for further developments and future research. In the first place, while the proposed four-stage methodology has been empirically tested through a representative Italian case study, an important next step is to apply this framework to a broader, cross-national dataset of distressed shopping malls. Doing so would allow for a deeper understanding of how local urban, demographic, and market conditions shape the ranking of adaptive reuse options. Secondly, the architectural design phase is particularly well suited to the use of generative design tools and building information modeling. A promising direction for future work is to integrate machine learning algorithms that can directly convert the AHP-derived criterion weights into generative spatial layouts. Training such algorithms to work within the constraints of retail buildings could help automate the architectural test-fit process, quickly producing a wide range of structurally sound and cost-effective layout solutions. Finally, several of the tools used within the four-stage methodology warrant further experimentation and refinement. One area of interest is multicriteria analysis, as there may be methods better suited than AHP to handling conflicting perspectives and priorities in a multi-stakeholder setting. Another promising line of research involves enriching the Monte Carlo simulation with additional variables – for instance, hard and soft costs, as well as planning and design approval times – to assess how these factors affect the probability distribution of the DCF evaluation metrics.

CRediT authorship contribution statement

Sergio Copiello: Writing – review & editing, Writing – original draft,

Supervision, Methodology, Formal analysis, Conceptualization. **Mauro Cristina Marzo:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision. **Eleonora Morbin:** Writing – review & editing, Writing – original draft, Visualization, Investigation, Data curation. **Pietro Bonifaci:** Writing – review & editing, Writing – original draft, Supervision, Formal analysis, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This work is an outgrowth of the master's degree thesis of EM, co-supervised by SC, MCM, and PB, to be defended at the University IUAV of Venice in March 2026.

The authors are grateful to HiRef S.p.A., particularly its CEO, Alberto Salmistraro, and CSMO, Nicola Rossi, for their support in designing the data center layout.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cities.2026.107380.

Data availability

Data is already included in the manuscript and the supplementary materials

References

Appraisal Institute. (2013). *The appraisal of real estate*. Chicago: Appraisal Institute.

Beckers, J., Weekx, S., Beutels, P., & Verhetsel, A. (2021). COVID-19 and retail: The catalyst for e-commerce in Belgium? *Journal of Retailing and Consumer Services, 62*, Article 102645. https://doi.org/10.1016/j.jretconser.2021.102645

Ben-Akiva, M., Bradley, M., Morikawa, T., Benjamin, J., Novak, T., Oppewal, H., & Rao, V. (1994). Combining revealed and stated preferences data. *Marketing Letters, 5*, 335–349. https://doi.org/10.1007/BF00999209

Berry, S. (2025). Prediction of retail chain failure: Examples of recent US retail failures. *Managerial and Decision Economics, 46*, 2838–2854. https://doi.org/10.1002/mde.4506

Berta, M., Bottero, M., Bravi, M., Dell'Anna, F., & Rapari, A. (2021). The regeneration of a shopping center starts from consumers' preferences: A best-worst scaling application. In O. Gervasi, B. Murgante, S. Misra, C. Garau, I. Blečić, D. Taniar, … C. M. Torre (Eds.), *Lecture Notes in Computer ScienceComputational science and its applications – ICCSA 2021* (pp. 533–543). Cham: Springer. https://doi.org/10.1007/978-3-030-87007-2_38.

Biron, B. (2019). *The last decade was devastating for the retail industry. Here's how the retail apocalypse played out.* Business Insider.

von Böhm-Bawerk, E. (1903). *Recent literature on interest*. London: The MacMillan Co.

Brunelli, M. (2018). A survey of inconsistency indices for pairwise comparisons. *International Journal of General Systems, 47*, 751–771. https://doi.org/10.1080/03081079.2018.1523156

Bullen, P. A. (2007). Adaptive reuse and sustainability of commercial buildings. *Facilities, 25*, 20–31. https://doi.org/10.1108/02632770710716911

Burayidi, M. A., & Yoo, S. (2021). Shopping malls: Predicting who lives, who dies, and why? *Journal of Real Estate Literature, 29*, 60–81. https://doi.org/10.1080/09277544.2021.1952050

Castigliano, F. (2023). Flaneuring the buyosphere: A comparative historical analysis of shopping environments and phantasmagorias. *Journal of Consumer Culture, 23*, 465–481. https://doi.org/10.1177/14695405221111454

Cavoto, G., & Limonta, G. (2013). The demalling process in Italy. *Revista Lusófona de Arquitectura e Educação, 8*(9), 65–84.

Chatterjee, S., Chaudhuri, R., & Vrontis, D. (2021). Examining the global retail apocalypse during the COVID-19 pandemic using strategic omnichannel management: A consumers' data privacy and data security perspective. *Journal of Strategic Marketing, 29*, 617–632. https://doi.org/10.1080/0965254X.2021.1936132

Chebat, J.-C., Michon, R., Haj-Salem, N., & Oliveira, S. (2014). The effects of mall renovation on shopping values, satisfaction and spending behaviour. *Journal of Retailing and Consumer Services, 21*, 610–618. https://doi.org/10.1016/j.jretconser.2014.04.010

Childs, M., Blanchflower, T., Hur, S., & Matthews, D. (2020). Non-traditional marketplaces in the retail apocalypse: Investigating consumers' buying behaviours. *International Journal of Retail & Distribution Management, 48*, 262–286. https://doi.org/10.1108/IJRDM-03-2019-0079

Chun, H., Joo, H. H., Kang, J., & Lee, Y. (2023). E-commerce and local labor markets: Is the "retail apocalypse" near? *Journal of Urban Economics, 137*, Article 103594. https://doi.org/10.1016/j.jue.2023.103594

Copiello, S. (2021). Economic viability of building energy efficiency measures: A review on the discount rate. *AIMS Energy, 9*. https://doi.org/10.3934/ENERGY.2021014

Copiello, S. (2016). A discounted cash flow variant to detect the optimal amount of additional burdens in public-private partnership transactions. *MethodsX, 3*, 195–204. https://doi.org/10.1016/j.mex.2016.03.003

Copiello, S., Gabrielli, L., & Bonifaci, P. (2017). Evaluation of energy retrofit in buildings under conditions of uncertainty: The prominence of the discount rate. *Energy, 137*, 104–117. https://doi.org/10.1016/j.energy.2017.06.159

Coutinho Guimarães, P. P. (2019). Shopping centres in decline: Analysis of demalling in Lisbon. *Cities, 87*, 21–29. https://doi.org/10.1016/j.cities.2018.12.021

Damodaran, A. (2006). Valuation approaches and metrics: A survey of the theory and evidence. *Foundations and Trends in Finance, 1*, 693–784. https://doi.org/10.1561/0500000013

Daniel, C., & Hernandez, T. (2024). What retail apocalypse? A Delphi forecast of commercial space demand in the Toronto region. *Journal of Retailing and Consumer Services, 77*, Article 103670. https://doi.org/10.1016/j.jretconser.2023.103670

Dilmore, G. (1971). *The new approach to real estate appraising*. New Jersey: Prentice Hall.

Downs, A. (1966). Characteristics of various economic studies. *The Appraisal Journal, 34*, 329–338.

Dunham-Jones, E., & Williamson, J. (2017). Dead and dying shopping malls, re-inhabited. *Architectural Design, 87*, 84–91. https://doi.org/10.1002/ad.2220

Dunham-Jones, Ellen, & Williamson, June (2011). *Retrofitting suburbia : urban design solutions for redesigning suburbs*. Hoboken: John Wiley & Sons.

Elmashhara, M. G., & Soares, A. M. (2019). Entertain me, I'll stay longer! The influence of types of entertainment on mall shoppers' emotions and behavior. *Journal of Consumer Marketing, 37*, 87–98. https://doi.org/10.1108/JCM-03-2019-3129

Escudero-Gómez, L. A., & Lois-González, R. C. (2025). Beyond the retail apocalypse. In L. A. Escudero-Gómez, & R. C. Lois-González (Eds.), *Urban retail geographies* (pp. 33–56). London: Routledge. https://doi.org/10.4324/9781003622475-3.

Feldman, L. (2004). Successful investment and turnaround strategies for distressed shopping centre properties. *Journal of Retail and Leisure Property, 4*, 32–38. https://doi.org/10.1057/palgrave.rlp.5090195

Fisher, I. (1907). *The rate of interest*. New York: The MacMillan Co.

Fisher, I. (1930). *The theory of interest*. New York: The MacMillan Co.

Flanagan, R., Kendell, A., Norman, G., & Robinson, G. D. (1987). Life cycle costing and risk management. *Construction Management and Economics, 5*, S53–S71. https://doi.org/10.1080/01446193.1987.10462093

French, N., & Gabrielli, L. (2005). Discounted cash flow: Accounting for uncertainty. *Journal of Property Investment & Finance, 23*, 75–89. https://doi.org/10.1108/14635780510575102

French, N., & Gabrielli, L. (2018). Pricing to market. *Journal of Property Investment & Finance, 36*, 391–396. https://doi.org/10.1108/JPIF-05-2018-0033

Greaves, M. J. (1972a). Discounted cash flow techniques and current methods of income valuation. *Estates Gazette, 223*, 2147–2151.

Greaves, M. J. (1972b). Discounted cash flow techniques and current methods of income valuation. *Estates Gazette, 233*, 2339–2345.

Gruen, V., & Smith, L. (1960). *Shopping towns USA: The planning of shopping centers*. New York: Reinhold.

Guimarães, P. (2018). The evolution of old shopping centres in the town centre of Braga, Portugal. *Journal of Urban and Regional Analysis, 10*, 127–141.

Guy, C. (1998). Classifications of retail stores and shopping centres: Some methodological issues. *GeoJournal, 45*, 255–264.

Harasta, J. (2020). Surviving the 'retail apocalypse': How Urban Outfitters became the bad boy of retail and lived to tell about it. *Journal of Brand Strategy, 8*, 303. https://doi.org/10.69554/KPDB7662

Helm, S., Kim, S. H., & Van Riper, S. (2020). Navigating the 'retail apocalypse': A framework of consumer evaluations of the new retail landscape. *Journal of Retailing and Consumer Services, 54*, Article 101683. https://doi.org/10.1016/j.jretconser.2018.09.015

Hoesli, M., Jani, E., & Bender, A. (2006). Monte Carlo simulations for real estate valuation. *Journal of Property Investment & Finance, 24*, 102–122. https://doi.org/10.1108/14635780610655076

Hoxha, V. (2019). Sustainable impact of adaptive reuse of communist style shopping malls in Kosovo. *Property Management, 37*, 662–683. https://doi.org/10.1108/PM-02-2019-0010

Ingene, C. A., & Brown, J. R. (2019). Conceptualizing a comprehensive theory of distribution channels. In *Handbook of research on distribution channels*. Edward Elgar Publishing. https://doi.org/10.4337/9780857938602.00035.

IVSC. (2001). *International valuation standards*. London.

Jacoboni, C., & Lugli, P. (1989). *The Monte Carlo method for semiconductor device simulation*. Wien-New York: Springer Verlag.

James, F. (1980). Monte Carlo theory and practice. *Reports on Progress in Physics, 43*, 1145–1189. https://doi.org/10.1088/0034-4885/43/9/002

Johannesson, M., Liljas, B., & Johansson, P.-O. (1998). An experimental comparison of dichotomous choice contingent valuation questions and real purchase decisions. *Applied Economics, 30*, 643–647. https://doi.org/10.1080/000368498325633

Kickert, C., vom Hofe, R., Haas, T., Zhang, W., & Mahato, B. (2020). Spatial dynamics of long-term urban retail decline in three transatlantic cities. *Cities, 107*, Article 102918. https://doi.org/10.1016/j.cities.2020.102918

Kishore, R. (1996). Discounted cash flow analysis in property investment valuations. *Journal of Property Valuation and Investment, 14*, 63–70. https://doi.org/10.1108/14635789610118280

Lange, A. (2022). *Meet me by the fountain: An inside history of the mall*. New York: Bloomsbury Publishing.

Langston, C., Wong, F. K. W., Hui, E. C. M., & Shen, L.-Y. (2008). Strategic assessment of building adaptive reuse opportunities in Hong Kong. *Building and Environment, 43*, 1709–1718. https://doi.org/10.1016/j.buildenv.2007.10.017

LeHew, M. L. A., & Fairhurst, A. E. (2000). US shopping mall attributes: An exploratory investigation of their relationship to retail productivity. *International Journal of Retail & Distribution Management, 28*, 261–279. https://doi.org/10.1108/09590550010328535

Li, L. H., Cheung, K. S., & Tse, W. S. (2023). Understanding the shoppers' perception in retail shopping malls: A self-determination theory perspective. *Journal of Strategic Marketing, 31*, 58–73. https://doi.org/10.1080/0965254X.2020.1870046

Lin, D. (2021). *Evolution of Malls in the United States from 2010 to 2020: Evidence of Survival and Transaction [Master of Science]*. Cornell University.

Loizou, P., & French, N. (2012). Risk and uncertainty in development. *Journal of Property Investment & Finance, 30*, 198–210. https://doi.org/10.1108/14635781211206922

Lowry, J. R. (1997). The life cycle of shopping centers. *Business Horizons, 40*, 77–86. https://doi.org/10.1016/S0007-6813(97)90029-X

Mansfield, J. R., & Pinder, J. A. (2008). "Economic" and "functional" obsolescence. *Property Management, 26*, 191–206. https://doi.org/10.1108/02637470810879233

Mao, L. L. (2022). Retail quality, market environment and business survival in the retail apocalypse: An investigation of the sporting goods retail industry. *International Journal of Sports Marketing and Sponsorship, 23*, 547–571. https://doi.org/10.1108/IJSMS-06-2021-0115

Marinic, G. (2026). Texas translations: Suburban obsolescence, multiculturalism, and adaptive reuse in the Dallas-Ft. Worth Metroplex. *Journal of Urban Affairs, 48*, 1426–1445. https://doi.org/10.1080/07352166.2025.2467667

Marshall, A. (1920). *Principles of economics*. London: The MacMillan Co.

Milan Board of Engineers and Architects. (2019). *Prezzi Tipologie Edilizie*. Rome: DEI.

Moore, P., Rothschild, C., & Rodden, D. (2023). *The State of the American Mall: Competitive, Attractive and Here To Stay*. Coresight Research.

Muposhi, A., Mafini, C., & Shamhuyenhanzva, R. M. (2022). Nipping the dead mall trend in the bud: A modified shopper-based mall equity model for South Africa's distressed malls. *International Journal of Electronic Marketing and Retailing, 13*, 43. https://doi.org/10.1504/IJEMR.2022.119245

Neufert, E. (2023). *Architects' data*. Oxford: Wiley-Blackwell.

Peterson, H. (2018). *A tsunami of store closings is about to hit the US — And it's expected to eclipse the retail carnage of 2017*. . Business Insider.

Philipose, S. (2019). *Retail apocalypse - the death of malls, retailers, & jobs*. Turin: Amazon.

Raffaelli, R., & Noe, R. (2025). Organizational emplacement as a response to digital threat: The novel resurgence of independent bookstores. *Administrative Science Quarterly*. https://doi.org/10.1177/00018392251333696

Rao, F. (2020). Shopping Centre morphologies in transition: Towards a morphological typology of retail synergies. *Urban Design International, 25*, 310–327. https://doi.org/10.1057/s41289-020-00114-w

Ratcliff, R. U. (1972). *Valuation for real estate decisions*. Santa Cruz: Democrat Press.

Reimers, V., & Clulow, V. (2009). Retail centres: It's time to make them convenient. *International Journal of Retail & Distribution Management, 37*, 541–562. https://doi.org/10.1108/09590550910964594

Roberts, E., & Carter, H. C. (2023). Adaptive reuse of closed malls for dementia programs and services: Community focus group feedback. In *(Re)designing the continuum of care for older adults* (pp. 197–216). Cham: Springer. https://doi.org/10.1007/978-3-031-20970-3_11.

Roggeveen, A. L., & Sethuraman, R. (2020). How the COVID-19 pandemic may change the world of retailing. *Journal of Retailing, 96*, 169–171. https://doi.org/10.1016/j.jretai.2020.04.002

Rosenbaum, M. S., Ramirez, G. C., El-Manstrly, D., & Sit, J. (2021). Shoppers' neural responses to the mere social presence of others: Insights from an enclosed mall. *The International Review of Retail, Distribution and Consumer Research, 31*, 281–298. https://doi.org/10.1080/09593969.2021.1901764

Saaty, T. L. (1980). *The analytic hierarchy process*. New York: McGraw-Hill.

Saaty, T. L. (1977). A scaling method for priorities in hierarchical structures. *Journal of Mathematical Psychology, 15*, 234–281. https://doi.org/10.1016/0022-2496(77)90033-5

Saaty, T. L. (1983). Priority setting in completing problems. *IEEE Transactions on Engineering Management, 30*, 140–155.

Saaty, T. L. (1984). The analytic hierarchy process: Decision making in complex environments. In *Quantitative assessment in arms control* (pp. 285–308). Boston, MA: Springer US. https://doi.org/10.1007/978-1-4613-2805-6_12.

Shankar, A., Gupta, M., Tiwari, A. K., & Behl, A. (2021). How does convenience impact showrooming intention? Omnichannel retail strategies to manage global retail apocalypse. *Journal of Strategic Marketing*, 1–22. https://doi.org/10.1080/0965254X.2021.1965189

Shankar, A., Gupta, M., Tiwari, A. K., & Behl, A. (2025). How does convenience impact showrooming intention? Omnichannel retail strategies to manage global retail apocalypse. *Journal of Strategic Marketing, 33*, 394–415. https://doi.org/10.1080/0965254X.2021.1965189

Shen, L., & Langston, C. (2010). Adaptive reuse potential. *Facilities, 28*, 6–16. https://doi.org/10.1108/02632771011011369

Sheth, J. (2020). Impact of Covid-19 on consumer behavior: Will the old habits return or die? *Journal of Business Research, 117*, 280–283. https://doi.org/10.1016/j.jbusres.2020.05.059

Spanke, M. (2020). *Retail isn't dead*. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-36650-6

Statista. (2024). *Shopping centers in the U.S. - statistics & facts*. https://www.statista.com/topics/7422/shopping-centers-in-the-united-states/ [last accessed 01.02.2025].

Stevens, S. S. (1946). On the theory of scales of measurement. *Science (1979), 103*, 677–680.

Taleb, N. N. (2010). *The black swan: The impact of the highly improbable*. New York: Random House.

Tamini, L. (2018). *Re-activation of vacant retail spaces*. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-70872-0

Thompson, D. (2017). *What in the world is causing the retail meltdown of 2017?* The Atlantic.

Tian, W. (2013). A review of sensitivity analysis methods in building energy analysis. *Renewable and Sustainable Energy Reviews, 20*, 411–419. https://doi.org/10.1016/j.rser.2012.12.014

Tokosh, J. (2018). You're dead to me, but should you be? Using a retail database to classify American malls by occupancy and sales and an extended analysis of dead and dying malls. *The International Review of Retail, Distribution and Consumer Research, 28*, 490–515. https://doi.org/10.1080/09593969.2018.1509801

Warf, B. (1994). Vicious circle: Financial markets and commercial real estate in the United States. In S. Corbridge, N. Thrift, & R. Martin (Eds.), *Money, power, and space*. Cambridge: Blackwell Publishers.

Williamson, June, & Dunham-Jones, Ellen (2021). *Case studies in retrofitting suburbia : urban design strategies for urgent challenges*. Hoboken: John Wiley & Sons.

Wyatt, P. (2013). *Property valuation*. Oxford: Wiley-Blackwell.

Yang, E., Hong, S., & Kim, Y. (2022). Factors influencing adaptive reuse of declining shopping malls in the U.S.: A multi-stakeholder view. *Journal of Green Building., 17*, 83–108. https://doi.org/10.3992/jgb.17.2.83