Analyzing causes of urban blight using cognitive mapping and DEMATEL

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Abstract

Blight is a concept not commonly discussed. However, blight is a problem that exists in the lives of many people, especially if they reside in urban areas. Blight originates whenever properties are neglected, contributing to both a functional and social depreciation process and ultimately leading to uninhabitable dwellings. Despite being blighted, these properties and surrounding neighborhoods often are occupied by families who fail to have sufficient income to afford residences that meet minimum standards or to live in neighborhoods free from drug trafficking and prostitution or other forms of crime. Blight may spread rapidly, thus, experts must, in a timely manner, analyze its causes, which are essential to preventing and mitigating blight problems. The purpose of this study is to seek an understanding of blight and identify its causal factors. The generic methods commonly applied in previous blight research present limitations that this study aims to overcome by using cognitive mapping and the decision making trial and evaluation laboratory (DEMATEL) technique. This dual methodology provides a more transparent and less restrictive approach for analyzing and complying with the dynamics of cause-and-effect relationships among variables. Group debate involving a panel of specialists in this field identified six causation clusters based on the experts’ experience and knowledge. The resulting framework and its application were validated both by these
specialists and the head of the Territorial and Environmental Assessment and Monitoring Division of Cascais City Council Strategic Planning Department, Portugal.

Keywords  Blight · Cognitive mapping · DEcision MAking Trial and Evaluation Laboratory (DEMATEL) · Multiple Criteria Decision Analysis (MCDA) · Strategic Planning · Urbanization

1 Introduction

With the industrial revolution, humanity’s habits started to change radically, leading to profound changes in people’s lives. One of the most eventful societal transformations was the intensity of urbanization, resulting in migration to cities. Urbanization was primarily motivated by individuals’ search for a higher quality of life manifested by better jobs, general infrastructure improvements, and housing (Dye, 2008; Ochoa et al., 2018; Shen et al., 2018; Zhang & Song, 2003).

Over time, poor—or the absence of—strategic urban planning caused cities to become overpopulated with declining residential infrastructure. This resulted in serious unemployment and household structural problems drastically affecting residents’ quality of life (Correia et al., 2020; Costa et al., 2021; Darling, 1943; Ernst, 2008). These continued trends contributed to other problems, including urban or neighborhood blight, where neglected properties deteriorate, causing depreciated valuations. Housing conditions in blighted areas thus fall far below each city’s property standards (Darling, 1943; South et al., 2015). Blight is a widespread and increasing problem in many large metropolises. Blight not only potentially triggers other issues, such as drug trafficking and prostitution, but also, unchecked, spreads quickly. Therefore, blight prevention and mitigation are crucial to reducing blight occurrences when it first appears (Ernst, 2008; Ferreira et al., 2018; Hu et al., 2021; Marques et al., 2018; Pires et al., 2018).

Blight and its causes is a complex topic, inherently subjective and lacks a universally accepted definition (Jones-Farmer & Hoerl, 2019; Shlay & Whitman, 2006; Wagner, 2018; Weaver, 2013), making blight research and its mitigation extremely difficult to conduct. Picard (1939) and Darling (1943) were pioneers in addressing urban blight, yet it is thought of as a relatively recent issue affecting contemporary societies (Barão et al., 2021; Ferreira et al., 2018; Valasik et al., 2019). In this context, urban planning and prevention and mitigation of blight play crucial roles in dealing with blight, both in terms of residents’ quality of life and well-being of future generation.

A few previous models addressing blight have limitations regarding blight’s clarification, conceptualization, causes, and analyses of cause-and-effect relationships among decision criteria (Ferreira et al., 2018; Lousada et al., 2021; Pinto et al., 2021). Our study, given these limitations and blight’s complexity and subjectivity, uses multiple criteria decision analysis (MCDA) to combine structuring and evaluation methods that address a myriad of factors associated with blight. Specifically, cognitive mapping was applied to identify, select, hierarchize, and group causes of blight. In addition, the decision-making trial and evaluation laboratory (DEMATEL) method was used to carry out quantitative analyses of blight’s causes, facilitating prioritization and classification of these causes and the clarification of their interrelationships’ dynamics. These combined techniques address many of the limitations associated with previous attempts at measuring and categorize blight.
Objectively, the combined application of cognitive mapping and DEMATEL more effectively and transparently identifies blight causes, thus facilitating decision-making processes. This combined application assists planners and decision makers in formulating and implementing possible anti-blight strategies and initiatives. This framework may have broader applications, but in this study it is applied to urban environments, helping stakeholders to avoid the deterioration of residential and commercial neighborhoods, contributing to an improved balance between the sustainability of the real estate market and the needs of society in general. Therefore, the results of this study help extend the understanding of blight causes and identifies specific procedures, which provide city administrators with sufficient information to confidently address actions aimed at identifying, preventing and eradicating urban blight in their estate/land use policies. This study adopts a constructivist posture based on learning through participation. We found no evidence of prior studies adopting this or similar approaches or techniques to analyze urban blight’s causes. Thus, we believe that this study contributes significantly to the extant literature on blight, urban planning, and operational research/management science (OR/MS).

The remainder of this paper is structured as follows. The next section presents an overview of existing blight literature. Section three describes our methodology. Section four analyzes the results obtained from the application of the proposed model, while section five contains the study’s main conclusions, limitations, and contributions to the existing knowledge on urban blight. Suggestions for future research are also included in this final section.

2 Literature review

In recent decades, humanity has witnessed unprecedented urbanization (Zhang et al., 2019b, 2019a). Urbanization is defined as the increased concentration of people in cities and the flow of populations from rural to urban areas (Chan & Hu, 2003; Gu et al., 2012; Ochoa et al., 2018; Ren et al., 2018; Street, 1997; Wang et al., 2019; Zhang & Song, 2003). The United Nations (UN) further defines urbanization as “a complex socio-economic process that transforms the built environment, converting formerly rural into urban settlements” (UN, 2019:3). The expansion of urban zones has made delineating where they end and where rural areas begin increasingly difficult (Ferreira et al., 2010).

Data gathered by the UN (2019) supports the continuing occurrence of rapid urban population growth. In 1950, 30% of the world’s population lived in urban areas, but, by 2018, the number had risen to 55%, representing an urban population growth from 751 million to 4.2 billion. This trend is expected to continue, and experts predict that, in 2050, 68% of the world’s population will reside in urbanized zones. Cities’ rapid population expansion has contributed to a high level of congestion in terms of not only traffic, but also hospitals, schools, and workplaces. Consequently, metropolises have been unable to fully respond to their inhabitants’ needs, especially in large cities (Wang et al., 2019; Zhang & Song, 2003). These effects have drastically reduced city residents’ quality of life.

However, quality of life problems could be avoided—or could be less harmful—if more effective strategic planning and effort were put into place from the start (Castanho et al., 2021; Street, 1997). Various authors have suggested strategic planning that guides initiatives and activities as a tool to help managers achieve their organization’s objectives (Amrollahi & Rowlands, 2018; Brito et al., 2019; Klag & Langley, 2014; Poister & Streib, 2005). Also, Barney (1991), Mintzberg (1991), Del Pero (2013), Klag and Langley (2014), and Barney and Mackey (2018) recommend strategic plans that allocate resources efficiently and effectively.
to optimize entity performances. Using strategic planning, managers can maintain a favorable balance between organizational and local environmental issues, thereby achieving sustainable competitive advantages (Klag & Langley, 2014; Poister & Streib, 2005; Uzarski & Broome, 2019).

Currently, city planning far exceeds only an economic focus. Attitudes regarding planning and developing strategies for urban areas must take into account social and environmental aspects, addressing the triple bottom line (TBL) (Lousada et al., 2021; Wise, 2016). This perspective promotes sustainable development, where environmental protection becomes a central challenge for all governments and, more critically, for all markets in the twenty-first century (Costa et al., 2021; Elkington, 2017; Fernandes et al., 2018). Thus, municipal planners must focus particularly on blight, one of the major urban area topics impacting TBL.

Blight, urban blight, or neighborhood blight lacks a universally accepted definition (Beers et al., 2011; Breger, 1967; Jones-Farmer & Hoerl, 2019; Weaver & Bagchi-Sen, 2013). However, much of blight’s ambiguity results from its being an extremely subjective term that involves a multidisciplinary interpretation of different criteria. Breger (1967) was the first to suggest that blight arises from property deterioration or depreciation at both a functional and social level, where properties deteriorate to unusable standards. However, since the advancement of the TBL pillars, blight’s definitions should include: (1) non-acceptance; (2) real property; and (3) depreciation.

In short, immovable property suffers from blight as real estate depreciates through a deterioration process, moving from habitable to uninhabitable. For example, Valasik et al., (2019: 189) define blight as “conditions upon or affecting premises, which are hazardous to the health, safety or welfare of the public, and/or conditions which are detrimental to property values, economic stability, or to the quality of the environment”. Notably, blighted and abandoned property may be different, with blight being the more comprehensive term (Ferreira et al., 2018). Blight is property that fails to offer minimal conditions to accommodate residency, whether empty, abandoned, or still inhabited (Darling, 1943; Ferreira et al., 2018). Figure 1 provides examples of blight.

Blighted properties, lacking minimal dwelling conditions, reduce the quality of life of those who live there (Darling, 1943; Ferreira et al., 2018; Picard, 1939; Valasik et al., 2019), especially for children (Ferreira et al., 2018). However, blight is even a much larger, more complex problem than the affected property itself, since blight also has drastic consequences for the surrounding neighborhood and the entire community (Beers et al., 2011; Chronopoulos, 2014; Ernst, 2008) at an economic, environmental, and social level.
Urban blight is a serious problem given that experts estimate that half of all urban populations live in blighted conditions (Darling, 1943; Hosseini et al., 2017). Blight abatement or eradication for general equality among city neighborhoods has long been a main housing policy focus in the United States, the European Union, and, increasingly, the rest of the world (Arvan & Nickerson, 2006). We agree with the general perception that an acceptable definition of blight is necessary to combat this issue and minimize the problems associated with its subjectivity (Weaver, 2013). Blight prevention is a particularly key element in the fight against blight (Barão et al., 2021). Table 1 identifies some studies related to blight, highlighting their contributions and limitations.

Table 1 reflects the growing concern in recent years regarding blight, as well as the pursuit for new models/methods that determine causes of blight, its amelioration and eradication. Recent trends may be identified by observing each study’s year of publication (i.e., less than five years ago). As mentioned previously, urban blight is extremely complex and subjective, complicating its analysis and measurement. Therefore, the applied methodologies presented in Table 1 are not exempt from limitations, which require further examination to facilitate an accurate focusing on blight’s causes and its eradication.

The main recurring limitation in recent blight research is the failure to identify a sociotechnical mechanism that facilitates decision makers in identifying blight’s causes, including the cause-and-effect dynamics among perceived causes (Assunção et al., 2020; Ferreira et al., 2018). Our broader, more transparent study relies on a constructivist and complementarity approach by integrating cognitive mapping and MCDA with the participation of specialists in urban rehabilitation.

3 Methodology

Our study’s constructivist stance guided the method selection process that supported determining possible causes of blight. To this end, cognitive mapping and DEMATEL techniques were combined to structure the decision problem under analysis.

Four major factors influenced the selection of the methodology applied in this study. First, cognitive mapping and DEMATEL are two well-established socio-technical methods recognized as being relatively simple to apply and facilitate decision making across a range of organizational contexts (cf. Belton & Stewart, 2002). Second, as recommended by Belton and Stewart (2002), the selection of the methodology takes into account not only the decision context but also the expert panel’s characteristics. Third, two of DEMATEL’s key features are the capacity to include both qualitative and quantitative criteria and effectively address their interdependencies in analyzing cause-and-effect relationships (Gabus & Fontela, 1973). Last, despite cognitive mapping and DEMATEL’s relative popularity, their combined use is quite unique, and the literature offers no prior evidence of their combined application in identifying causes of urban blight. This supports our assertion that the combined application of cognitive mapping and DEMATEL is a novelty in the study of urban blight.

3.1 Cognitive mapping

In the 1970s, the objectivity of hard OR/MS methods was called into question when more complex, intangible social problems began to generate a high level of interpretation and uncertainty that could not be solved based on traditional OR/MS premises (Kirby, 2007; Rosenhead, 2013; Rosenhead & Mingers, 2001). To respond to these limitations, novel
| Authors                  | Methods                        | Contributions                                                                                                           | Limitations acknowledged by authors                                                                 |
|-------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Haney (2007)            | Structural equation model      | Confirmed a strong relationship between poverty and self-esteem<br>Shown how bad neighborhoods can affect self-esteem | Perceptions of self-esteem in each neighborhood appear to be ambiguous and complex<br> The data collected and analyzed are old, so they may no longer correspond to reality |
| Brueckner and Helsley (2011) | Period 2 analysis              | Demonstrated how urban expansion and urban blight result from the same economic processes as both are responses to failures that affect the real estate market<br> Revealed that, due to these problems’ causes, no reinvestment occurs in affected areas<br> Confirmed that corrective measures can address these problems and reduce blight in central areas | This study only focuses on one aspect of an extremely complex problem<br> Poverty and neighborhoods’ externalities are also important causes to consider when combating blight, and both must be subjected to the same level of analysis |
| Hsu and Juan (2016)     | Artificial neural network      | Proposed a decision-support model that allows managers to select different strategies for reusing and restoring properties and create highly sustainable and efficient buildings | The model was only tested in one city and in a specific context<br> A comprehensive understanding of the topic is required to determine all possible factors that influence properties’ reuse |
| Hosseini et al. (2017)  | Delphi method                  | Showed that quickly renewing blighted areas is essential to prevent other residents from “running away”<br> Demonstrated that, even if insufficient money is available, a resident participation strategy is essential | The local population does not have the necessary knowledge to provide ideas on how to fight blight, so these must come from experts in the relevant areas |
| Authors                  | Methods                                                                 | Contributions                                                                 | Limitations acknowledged by authors                                                                                                                                                                                                 |
|-------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fernandes et al. (2018) | Cognitive mapping and analytic hierarchy process (AHP)                  | Used cognitive maps and the AHP method to prioritize determinants of sustainable development in urban areas | The research lacked an analysis of the dynamics of cause-and-effect relationships between the decision criteria under study                                                                                                                                                       |
| Ferreira et al. (2018)  | Cognitive mapping and measuring attractiveness by a categorical-based evaluation technique | Created an index to identify intervention priorities Determined that the “most vulnerable visible aspect” factor best indicates which areas need interventions | No analysis was conducted of the dynamics of cause-and-effect links between the variables in question                                                                                                                                                                           |
| Wagner (2018)           | Tax increment financing (TIF)                                           | Showed that TIF has the potential to provide tax-neutral financing for blighted areas Confirmed that economic stability must be achieved in blighted areas | TIF does not have an absolute rate of return, and this approach is strongly dependent on both local and macroeconomic market conditions                                                                                                                                               |
| Pearson et al. (2019)   | Regression model                                                        | Provided proof that a relationship exists between the human microbiome and neighborhood conditions, indicating opportunities for further research on green areas’ effect on residents in the vicinity and blight’s impact on health Demonstrated that microbial biodiversity has a positive correlation with green areas and a negative one with blight | The results are limited by a focus on only a short period The research only evaluated the conditions of one residential neighborhood, so the findings cannot be generalized The green areas studied did not have the same proportions as the blighted areas, which means the latter account for a greater share of the effects |
approaches were developed using different methods of analysis that approached problems from a more philosophical perspective and utilized more qualitative approaches to overcome the limited applicability of classic OR/MS.

These new methodologies are known as problem-structuring methods or soft OR/MS (Kirby, 2007; Lami & Tavella, 2019; Rosenhead & Mingers, 2001). One of the most popular soft approaches to structuring complex problems is the strategic options development and analysis (SODA) method (Ackermann & Eden, 2001). This methodology is particularly useful with subjective and difficult to interpret decision problems (Ferreira, 2005; Rouwette et al., 2011). The SODA approach is based on cognitive mapping techniques (Carayannis et al., 2018; Rouwette et al., 2011; Vaz de Almeida et al., 2019) that serve as a structuring tool to create mental representations (Ferreira, 2005; Rosenhead & Mingers, 2001).

Eden (2004: 673) defines cognitive maps as “the representation of thinking about a problem that follows from the process of mapping”. The maps are composed of concept constructions (i.e., nodes), linked by chains (i.e., links) that represent analysis systems’ behavior (Eden & Ackermann, 1998; Rosenhead, 2013) and the direction of implications embedded in the visualized beliefs or arguments (Eden & Ackermann, 2004). Cognitive maps are thus schematic representations that incorporate information and guide thinking (Ferreira, 2005), in which meaning is given to concepts and/or nodes by not only the relevant constructs but also the consequences attributed to those concepts, as well as the explanatory constructs that support the nodes (Eden & Ackermann, 2004).

A decision problem’s structuring phase is arguably the most important part of the decision-making process (Bana e Costa et al., 1997; Eden & Ackermann, 2004; Ferreira, 2005). In our structuring phase, we develop cognitive maps that contribute to a better understanding of the decision problems under study by enabling a survey of concepts that can then be investigated in greater detail. The use of cognitive maps and MCDA (Belton & Stewart, 2002) is particularly useful for organizations looking to make more empirically robust decisions when dealing with unstructured problems. These methods help specialists acquire more knowledge, a deeper understanding, and the ability to reflect on their own points of view, values, and objectives and those of other specialists (Vaz de Almeida et al., 2019).

To prevent and/or eliminate blight, the first crucial step is to understand why it occurs (i.e., causes of blight) in order to structure it as a decision problem. In this context, a more constructivist view is important. Thus, the SODA method and cognitive mapping were selected to assist in structuring a holistic view to achieve a better understanding of the cause-and-effect relationships between blight’s causes.

3.2 DEMATEL

DEMATEL was developed by the Battelle Memorial Institute’s Geneva Research Center, in the 1970s (Gabus & Fontela, 1973). This technique has been integrated into the MCDA approach and has filled gaps in other methods through its acceptance of concepts’ interdependence and subjectivity and useful quantitative analyses (Chen et al., 2018; Kumar & Dixit, 2018). This methodology recognizes the interactions between causes and categorizes them into causes and effects, thereby contributing to a structured, hierarchical identification of viable solutions and highlighting decision-support systems’ most critical concepts (Si et al., 2018; Zhang et al., 2019b, 2019a). Compared to other methods, DEMATEL is a more effective, viable technique for evaluating criteria’s cause-and-effect relationships and prioritizing these factors by order of importance (Chen et al., 2020).
This technique consists of the following steps. The first is to develop an average matrix based on experts’ opinions or a literature review, while the second is to normalize the matrix. The third step is to construct a total relation matrix, and the fourth is to calculate the separate totals of the total relation matrix’s rows and columns. The last two steps are to estimate a threshold value ($\alpha$) and to develop a cause-and-effect relationship diagram (Dalvi-Esfahani et al., 2019; Sumrit & Anuntavoranich, 2013). Figure 2 and the following subsections outline these steps in greater detail.

### 3.2.1 Step one

To calculate the average matrix, a group of experts evaluates and solves a complex problem with $n$ factors. Each expert is asked to give their opinion regarding the degree of influence between any two factors based on a pairwise comparison. The degree to which a specific expert considers that factor $i$ affects factor $j$ is indicated as $\chi_{ij}$ and varies between 0 (no influence), 1 (weak influence), 2 (medium influence), 3 (strong influence), and 4 (very strong influence).

Each specialist’s opinion forms a non-negative $n \times n$ matrix constructed as $\chi^k = [\chi^k_{ij}]$, in which $k$ corresponds to the number of specialists who participated in the evaluation process with $1 \leq k \leq m$. Thus, $X^1$, $X^2$, $X^3$, $X^4$ are the matrices of $m$ specialists, and the diagonal elements of matrix $X^k$ are all set to zero. The average of the $m$ specialists’ scores is calculated using Eq. (1) to obtain the average matrix $Z = [z_{ij}]$ $n \times n$:

$$z_{ij} = \frac{1}{m} \sum_{i=1}^{m} \chi^k_{ij} \quad (1)$$

For this study, data for the first step (see Fig. 2) were specifically provided and approved by the panel members after intense collective discussion and negotiation. Although this procedure is non-linear and inherently subjective, an important feature is its allowing for interactive explorations of potential changes in the inputs to the model, such that the impact of such changes may be seen immediately. The importance of group dynamics and negotiations is highlighted, namely because group interactions allow individuals to confront and debate different opinions in reaching more consensual solutions. This offers opportunities for further discussion and represents more than “simple” average calculations (again, this reflects the constructivist nature of the study) (Belton & Stewart, 2002).
3.2.2 Step two

To normalize the initial direct relation matrix, matrix $D = [d_{ij}]$ is calculated based on the normalization of matrix $Z$ (i.e., the average matrix) and Eq. (2):

$$D = \frac{Z}{\lambda}$$

in which $\lambda$ represents a positive scalar equivalent to the greatest effect that the total of lines $i$ of matrix $Z$ has on other factors. In addition, $\lambda$ stands for the greatest effect that the total of columns $j$ of matrix $Z$ receives from the other factors, as shown in Eq. (3):

$$\lambda = \max \left( \max_{1 \leq j \leq n} \sum_{i=1}^{n} z_{ij}, \max_{1 \leq i \leq n} \sum_{j=1}^{n} z_{ij} \right)$$

Matrix $D$ presents values between the interval $[0, 1]$. Based on the Markov chain theory, $D^m$ is the powers of matrix $D$. For example, $D^2, D^3, \ldots, D^\infty$ guarantees convergent solutions to the matrix inversion, as Eq. (4) shows:

$$\lim_{m \to \infty} D^m = [0]_{n \times n}$$

3.2.3 Step three

The total relation matrix, matrix $T$, is an $n \times n$ matrix defined by Eq. (5):

$$T = \lim_{m \to \infty} (D + D^2 + \ldots + D^m) = D(1 - D^{-1})$$

in which $I$ is the identity matrix $n \times n$. The elements $t_{ij}$ represent the direct and indirect effects that factor $i$ has on factor $j$ because matrix $T$ reflects the total relationship between each factor in the analysis system.

3.2.4 Step four

The totals are calculated separately for the rows and columns of matrix $T$ (i.e., the total relation matrix), which are represented by the vectors $R$ or Eq. (6) and $C$ or Eq. (7), respectively:

$$R = [r_i]_{n \times 1} = \left( \sum_{j=1}^{n} t_{ij} \right)_{n \times 1}$$

$$C = [c_j]_1^1 = \left( \sum_{i=1}^{n} t_{ij} \right)_{1 \times n}$$

in which $[c_j]'$ is indicated as the transposed matrix. Thus, if $r_i$ is the total of matrix $T$’s line $i$, $r_i$ indicates the total value of the influence that this factor has on the other factors, both directly and indirectly. $C_j$ is the total of matrix $T$’s column $i$ which represents the total value this factor receives from the other factors, either directly or indirectly.

On the one hand, if $j = i$, the value of $(r_i + c_i)$ represents the total effects given and received by $i$, which is its degree of importance in the model. On the other hand, the value $(r_i - c_i)$ indicates $i$’s net contribution (i.e., degree of influence) in the system. The factors can then
be divided into two groups: drivers and receivers (i.e., causes and effects). When \((r_i - c_i)\) is positive, factor \(i\) belongs to the drivers or causes group along with other criteria with a net influence on other factors. If \((r_i - c_i)\) is negative, factor \(i\) belongs to the receivers or effects category, so the other factors influence factor \(i\).

### 3.2.5 Step five

An \(\alpha\) value is then calculated by averaging matrix \(T\)'s elements, as shown in Eq. (8):

\[
\alpha = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} t_{ij}}{N}
\]

in which \(N\) is the total number of elements in matrix \(T\). This calculation eliminates the elements with the least effect in matrix \(T\), which helps the researcher interpret the results and understand the relationships between factors.

### 3.2.6 Step six

A cause-and-effect diagram is constructed by mapping all sets of coordinates \((r_i + c_i, r_i - c_i)\) to visualize the criteria’s complex interrelationships. This diagram provides decision makers with the necessary information to identify the most important factors and their influence on other factors (Dalvi-Esfahani et al., 2019; Sumrit & Anuntavoranich, 2013). Although the DEMATEL technique has already been applied in various areas (Bakir et al., 2018; Trivedi, 2018), no evidence was found of its application in the context of blight’s causes.

The combined application of cognitive mapping and DEMATEL adopted for this study facilitates not only the development of a reliable, holistic model for analyzing blight’s causes, but also promotes added realism. This approach offers unique and significant added value regarding site specific as well as broader state-of-the-art studies of urban blight. Specifically, the application of cognitive mapping generates unique insights based on expert knowledge, which may fail to be uncovered when using statistical methods alone. DEMATEL, in turn, allows for analyses of the dynamics of causal links between the identified causes, thereby fostering more informed and conscious decision making based on variable-change analysis. Furthermore, this framework overcomes some of the main methodological limitations identified in previous research.

Notably, the procedural steps followed by this dual methodology focus on supporting interactive learning and a fruitful analysis of blight causes and possible eradication scenarios. As previously iterated, the combined application of cognitive mapping and DEMATEL promotes exchanges of ideas and experiences, boosts a deeper understanding of decision situations, and identifies possible cause-and-effect relationships among causes of blight. This allows questions such as “why does this happen?” to be answered. From an urban planning perspective, this methodology can help stakeholders manage and plan for eventualities using appropriate strategies and provide operational flexibility through urban planning decisions, thus supporting strategic planning in urban contexts.
4 Application and results

This study sought to analyze blight’s causes by using a multiple criteria approach. Our research relied on a combined application of cognitive mapping and DEMATEL that facilitated the development of a simple, transparent, and structured decision-support model to follow when evaluating blight’s causes. These techniques were applied with the assistance of a panel of experts on blight who participated in 2 group sessions of 4 h each.

To achieve the highest possible holistic model, we invited experts to join the panel based on their heterogeneity in terms of gender, age, and sector (i.e., public or private), as well as their diverse areas of activity. Given that blight is largely not well understood by most members of society or is not present in many individuals’ daily lives, a group of specialists were identified among those who previously had direct or indirect contact with blight through their work and/or experience. In the end, the selection process brought together a group of six experts. According to the literature, no ideal number has been defined regarding panel size, but it should range between 5 and 12 elements (Belton & Stewart, 2002; Eden & Ackermann, 2004).

The panel selected included: the president of the Parish Council of Misericórdia, two additional experts who were representatives of the Union of Parishes of Cacém and São Marcos, one of whom was in charge of public lighting and abandoned vehicles and areas and the other of public spaces and mobility. The remaining specialists were an urban planning architect from the Lisbon City Council’s territorial planning division, an independent architect with her own firm, and a researcher of blight-related phenomena.

Although our study’s results reflect ideas and experience of these particular participants, the procedures followed, when correctly employed, tend to work equally well with different participants or in other contexts. This aspect reflects the constructivist, process-oriented orientation of our framework, focusing more on process than specific desired outcomes (Ackermann, 2019; Bell & Morse, 2013; Fonseca et al., 2018; Ormerod, 2020). Thus, representativeness need not be a major concern.

4.1 Group cognitive map

The first group meeting was divided into three parts. The session started with a brief presentation of the research project, followed by an explanation of the methodology and overall analysis procedures. Next, each panel member was asked to introduce him or herself briefly in order to “break the ice” and help the group begin communicating and interacting. The facilitator then asked a trigger question (i.e., Based on your perception and professional experience, what factors or circumstances give rise to urban blight?). The goal was to encourage interactions and discussions among the panel members. At this stage, the “post-its technique” was applied (Ackermann & Eden, 2001), in which each criterion (i.e., cause of blight) was written on a separate post-it note. If that factor or circumstance negatively influences blight, a negative sign (−) was placed in the upper righthand corner of the respective post-it note. All notes were placed on a whiteboard that made visualization of the results easier for all the participants.

The subsequent procedures helped the experts structure the problem and culminated in the development of a cognitive map (Faria et al., 2018; Reis et al., 2019; Ribeiro et al., 2017). The specialists identified a wide variety of causes that provoke urban blight, after having touched on varied topics and deepened their discussion of others considered more relevant. This phase of the process produced a collection of 128 causes of urban blight, which is in
line with Eden and Ackermann’s (2004) observation that, normally, a cognitive map must contain between 90 and 120 criteria.

At this point, the panel moved on to the second part of the first session, in which the causes of blight were grouped into clusters. The specialists/partisan members were asked first to think about a single cluster and which causes of blight they would place in it. If any doubts were expressed about a certain cause of blight, the respective post-it note remained without a cluster and, as new clusters were created, the panel could again decide whether to include still-unclassified causes of blight in these new clusters (for further details on this procedure, see Ackermann and Eden (2001) and Carayannis et al. (2018)). Six clusters were identified: (1) urbanism; (2) public spaces; (3) social context; (4) economic context; (5) mobility; and (6) public policy. Notably, some causes belonged in more than one cluster, so some causes were placed above the clusters because the experts felt they were strategically related to all the clusters.

In the final part of the first session, the panel members ranked blight causes within the different clusters, placing the most important at the top and the least important at the bottom. This procedure allowed the experts to see the clusters and their indicators as a whole and further comment on their content. The outputs of the first group meeting were then used to develop a group cognitive map using the Decision Explorer software (http://www.banxia.com). Figure 3 presents the map’s final version, which was validated by the panel members after a collective analysis and discussion of its composition.

The map presented in Fig. 3 reveals the six clusters’ distribution, as well as the causes of blight within them. The largest cluster is located at the bottom of the map (i.e., social context), while less dense clusters appear at the top, including the causes of blight that the experts argued should be included in more than one cluster. During the model building process, rather than a single formulaic answer to the trigger question, the participants were encouraged to discuss possible causes of urban blight and promote a better understanding of associated cause-and-effect relationships. No restrictions were imposed, and the procedure allowed participants to...
be provided with a more holistic picture of urban blight problems. Thus, the group cognitive map enables a holistic, transparent, simple and equitable analysis of blight causes in urban areas, amenable to replication for similar analysis of blighted areas anywhere in the world. Once the group cognitive map was validated, the elements needed to analyze the dynamics between the causes present, so the DEMATEL technique could be applied, as discussed in the next subsection. Obviously, DEMATEL could have been applied without the cognitive map. However, as previously clarified, its combined application with cognitive mapping promotes exchanges of ideas and experiences, boosts a deeper understanding of decision situations, uncovers additional possible cause-and-effect relationships among blight’s causes, and provides a more-informed framework, supporting strategic planning in urban contexts.

4.2 DEMATEL application

The second session was scheduled for March 12, 2020. However, the situation in Lisbon, Portugal, regarding coronavirus disease-19 (COVID-19)—classified as a global pandemic from March 11 onward—closed down all activities not considered essential. The second session had to be postponed to ensure the participants’ safety, until it could be held in person. The relevant literature asserts that the room layout selected needs to facilitate group dynamics (Bana e Costa et al., 2014).

Although less than ideal, the long period of home confinement meant that the second session had to take place in an online format through the Zoom platform. Although the participants were all confined, a date and time when all panel members could be present proved even more difficult to find. For this reason, the second session was attended by only 5 of the 6 experts initially recruited. This type of situation is also discussed in the literature, and researchers have concluded that the results will not be negatively affected as long as the group continues to contain a minimum number of participants (cf. Azevedo & Ferreira, 2019).

The second session was divided into two parts. First, the cognitive map was revealed to the panel members, and they were asked to discuss any corrections, adaptations, or adjustments they would like to see made. Given the 6 clusters identified, 7 matrices had to be filled in to enable the application of the DEMATEL technique. The first matrix indicates the clusters’ influence on each other. The remaining matrices are made up of the most important indicators within each cluster, which were selected by the experts based on nominal group and multi-voting techniques.

The experts used the scale traditionally associated with DEMATEL to assess the influence between criteria (i.e., 0 = no influence; 1 = weak influence; 2 = average influence; 3 = strong influence; and 4 = very strong influence). The causes of blight were already structured into the six clusters: urbanism (C1); social context (C2); public spaces (C3); economic context (C4); mobility (C5); and public policy (C6). The clusters contained the 128 causes of blight identified in the first session and organized into the necessary format for the application of the DEMATEL technique. Table 2 presents the first matrix that emerged from the panel’s discussion of the influence exerted by the clusters listed on the left (i.e., on the horizontal lines) on the clusters placed along the top of the matrix (i.e., in the vertical columns). Since each cluster does not have any effect on itself—at least not in this initial phase—the matrix’s main diagonal was previously filled in with 0.0.

An analysis of Table 2 revealed that all clusters to some degree influence each other. Although C1 has an extremely strong effect on two clusters, C6 presents, in general, a stronger influence on the other clusters, with a total of 16.0 out of 24.0 possible. Both C1 and
C4 have a total of 15.5, followed by C3 (14.0), C5 (13.5), and ending with C2 (12.5). When the analysis focused on how much each cluster is influenced by the others, C6 was found to be the least affected (11.0), followed by C4 (13.5). C1, C2, and C5 all have a total of 15.5, but the most influenced is C3 (16.0).

These totals are an essential step in calculating the normalized initial matrix (see Table 3). This matrix together with the identity matrix (see Table 4) makes constructing matrix T finally possible. Tables 4, 5, and 6 show the intermediate steps in the latter matrix’s calculation.

After calculating the final matrix (see Table 7), R and C’s values could be estimated. R represents the total direct and indirect influence that a cluster has on the remaining clusters.

### Table 2 Initial matrix: clusters

|     | C1  | C2  | C3  | C4  | C5  | C6  | Total |
|-----|-----|-----|-----|-----|-----|-----|-------|
| C1  | 0.0 | 3.0 | 4.0 | 2.5 | 4.0 | 2.0 | 15.5  |
| C2  | 3.0 | 0.0 | 2.0 | 3.0 | 2.5 | 2.0 | 12.5  |
| C3  | 3.0 | 3.5 | 0.0 | 2.0 | 3.0 | 2.5 | 14.0  |
| C4  | 3.0 | 3.5 | 0.0 | 3.0 | 3.0 | 3.0 | 15.5  |
| C5  | 3.0 | 2.5 | 3.5 | 0.0 | 3.0 | 1.5 | 13.5  |
| C6  | 3.5 | 3.0 | 3.5 | 3.0 | 0.0 | 0.0 | 16.0  |
| Total | 15.5 | 15.5 | 16.0 | 13.5 | 15.5 | 11.0 |       |

### Table 3 Normalized initial matrix D for clusters

|     | C1     | C2     | C3     | C4     | C5     | C6     |
|-----|--------|--------|--------|--------|--------|--------|
| C1  | 0.0000 | 0.1875 | 0.2500 | 0.1563 | 0.2500 | 0.1250 |
| C2  | 0.1875 | 0.0000 | 0.1250 | 0.1875 | 0.1563 | 0.1250 |
| C3  | 0.1875 | 0.2188 | 0.0000 | 0.1250 | 0.1875 | 0.1563 |
| C4  | 0.1875 | 0.2188 | 0.1875 | 0.0000 | 0.1875 | 0.1875 |
| C5  | 0.1875 | 0.1563 | 0.2188 | 0.1875 | 0.0000 | 0.0938 |
| C6  | 0.2188 | 0.1875 | 0.2188 | 0.1875 | 0.1875 | 0.0000 |

### Table 4 Identity matrix I for clusters

|     | C1     | C2     | C3     | C4     | C5     | C6     |
|-----|--------|--------|--------|--------|--------|--------|
| C1  | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C2  | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| C3  | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 | 0.0000 |
| C4  | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 | 0.0000 |
| C5  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 |
| C6  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
Table 5 Matrix \((I - D)\) for Clusters

|    | C1     | C2   | C3    | C4     | C5     | C6    |
|----|--------|------|-------|--------|--------|-------|
| C1 | 1.0000 | -0.1875 | -0.2500 | -0.1563 | -0.2500 | -0.1250 |
| C2 | -0.1875 | 1.0000 | -0.1250 | -0.1875 | -0.1563 | -0.1250 |
| C3 | -0.1875 | -0.2188 | 1.0000 | -0.1250 | -0.1875 | -0.1563 |
| C4 | -0.1875 | -0.2188 | -0.1875 | 1.0000 | -0.1875 | -0.1563 |
| C5 | -0.1875 | -0.1563 | -0.2188 | -0.1875 | 1.0000 | -0.0938 |
| C6 | -0.2188 | -0.1875 | -0.2188 | -0.1875 | -0.1875 | 1.0000 |

Table 6 Matrix \((1 - D)^{-1}\) for clusters

|    | C1    | C2    | C3    | C4    | C5    | C6    |
|----|-------|-------|-------|-------|-------|-------|
| C1 | 2.5455 | 1.7108 | 1.7936 | 1.5088 | 1.7591 | 1.2601 |
| C2 | 1.4607 | 2.3091 | 1.4541 | 1.3172 | 1.4483 | 1.0812 |
| C3 | 1.5794 | 1.6073 | 2.4619 | 1.3770 | 1.5889 | 1.1902 |
| C4 | 1.7168 | 1.7459 | 1.7607 | 2.3864 | 1.7266 | 1.3173 |
| C5 | 1.5404 | 1.5267 | 1.6042 | 1.3860 | 2.3940 | 1.1184 |
| C6 | 1.7869 | 1.7724 | 1.8344 | 1.5856 | 1.7766 | 2.1954 |

Table 7 Final Matrix \(T\) for Clusters

|    | C1    | C2    | C3    | C4    | C5    | C6    | R    |
|----|-------|-------|-------|-------|-------|-------|------|
| C1 | 1.5455 | 1.7108 | 1.7936 | 1.5088 | 1.7591 | 1.2601 | 9.5779 |
| C2 | 1.4607 | 1.3091 | 1.4541 | 1.3172 | 1.4483 | 1.0812 | 8.0707 |
| C3 | 1.5794 | 1.6073 | 2.4619 | 1.3770 | 1.5889 | 1.1902 | 8.5697 |
| C4 | 1.7168 | 1.7459 | 1.7607 | 2.3864 | 1.7266 | 1.3173 | 9.9513 |
| C5 | 1.5404 | 1.5267 | 1.6042 | 1.3860 | 2.3940 | 1.1184 | 8.4654 |
| C6 | 1.7869 | 1.7724 | 1.8344 | 1.5856 | 1.7766 | 2.1954 | 9.9513 |
| C  | 9.6298 | 9.6722 | 9.9089 | 8.5611 | 9.6936 | 7.1625 |

\(C\) indicates the total effect that a cluster receives from the remaining clusters, directly or indirectly.

Table 8 includes the addition and subtraction of the two variables’ values. \(R + C\) reveals the total effects given and received by the cluster in question. That is, the higher the \(R + C\) value, the more prominent this cluster will be. The overall ranking of the determinants clusters’ importance is as follows: \(C1 > C2 > C5 > C4 > C3 > C6\). \(R - C\), in contrast, indicates each cluster’s level of influence on and thus relationships within the model, after which the clusters can be divided into two groups—receivers and drivers—if \(R - C\) is negative or positive, respectively. In this case, the majority are recipients or effects, so these clusters’ relationships with the remaining clusters are weak and they are overall more influenced than...
they influence others. The exceptions are C4 and C6, which are donors or causes. That is, they have strong relationships with the other clusters, in which the two clusters influence the others. Notably, C1 influences almost as much as it is influenced, which is one of the reasons that it is more important in the analysis system.

To facilitate the comprehension and analysis of the relationships among clusters, the $\alpha$ value (1.5174) was calculated, which represents the average of all of matrix $T$’s elements and can be used to eliminate the criteria with a weaker effect on this matrix. The values in the green and red boxes, shown in Table 7, are the values above and below $\alpha$, respectively. With the combinations of $R$ and $C$ and $\alpha$ defined, a more detailed analysis could be conducted of this final matrix.

Based on the $\alpha$ value for the final matrix, a cause-and-effect diagram was also created (see Fig. 4), which provided a better, faster, and clearer visualization of the importance of influences within the model. The most significant values were then highlighted in green (see Table 7). Everything above zero on the $R–C$ axis is a cause (i.e., drivers), everything below zero is an effect (i.e., receivers). In addition, the farther to the right of the $R + C$ axis a cluster is, the more important that cluster will be. Figure 4 reinforces the results already gained by estimating $R + C$, in which C1 on the right is the most important and C6 on the left is the least important. C4 and C6 are donors that influence the remaining clusters more than the latter affect these two clusters.

A four-quadrant impact-relation map (IRM) was created by calculating the mean of $R + C$. Figures 4 and 5 reveal that C6 has an extremely low prominence despite having strong

### Table 8 Clusters’ $R$ and $C$

| Cluster | $R$    | $C$    | $R + C$ | $R – C$ |
|---------|--------|--------|---------|---------|
| C1      | 9.5779 | 9.6298 | 19.2077 | −0.0518 |
| C2      | 8.0707 | 9.6722 | 17.7429 | −1.6015 |
| C3      | 8.8047 | 9.9089 | 18.7137 | −1.1042 |
| C4      | 9.6537 | 8.5611 | 18.2147 | 1.0926  |
| C5      | 8.5697 | 9.6936 | 18.2633 | −1.1239 |
| C6      | 9.9513 | 7.1625 | 17.1138 | 2.7888  |
relationships with the other clusters. C6 was thus identified as a “driving” factor or “autonomous” giver, while C4 has a relatively high prominence and strong relationships, being considered a “core” factor or “intertwined” giver. Among the effects or receivers, C2 has the lowest prominence and weakest relationship values, indicating that it is an “independent” factor or “autonomous” receiver. The remaining clusters have low relationship values but a high prominence, so these clusters are considered to be “impact” factors or “intertwined” receivers, with C1 standing out in this category.

The procedure followed in the intra-cluster analysis was the same and repeated for each of the six individual clusters to clarify cause-and-effect relationships among causes of blight. Although panel members used the terms “significant” and “important” alternately as synonyms in their discussion/negotiation process, it is worth noting that quadrant I includes the most prominent and strongly connected core causes of urban blight. Quadrant II contains autonomous driving causes that are not prominent but that have strong relationships. Quadrant III comprises the independent causes of blight that are not prominent and that have weak relationships. Finally, quadrant IV incorporates the quite prominent impact causes that, nonetheless, have weak connections. Given the sizeable clusters, the most significant causes of blight in each cluster were selected using nominal group and multi-voting techniques. To ensure a more coherent exploration, the clusters were analyzed in descending order based on their importance within the model (i.e., $R + C$ values).

Starting with the urbanism cluster, the causes of blight or “specific concepts” (SCs) that panel members considered to be of greater importance were vacant buildings (SC9), abandoned dwellings (SC12), a low level of or insufficient infrastructure (SC13), renovations (SC17), evictions of the local population (SC18), a lack of equipment (SC31), and illegal buildings (SC30). The IRM diagram in Fig. 6 shows that a low level of or insufficient infrastructure is the most prominent SC and that it has the strongest relationships in the model, making this a core factor in combination with evictions of local populations. A lack of equipment and illegal buildings, despite having strong relationships with the other causes of
The remaining SCs have weak values, with vacant buildings having a low prominence (i.e., an independent factor) and abandoned dwellings and renovation being quite prominent (i.e., impact factors).

Moving on to the public spaces cluster, the most important causes chosen by the panel members are street crime (SC38), dark places (SC39), placement of public spaces (SC43), degraded public spaces (SC44), and a lack of green spaces (SC46). As can be seen in Fig. 7, the most prominent factors within this cluster (i.e., degraded public spaces and dark places) are factors with weak relationships (i.e., impact factors). Street crime has a low relationship value and prominence, so it is an independent factor, while the rest (i.e., a lack of green spaces and placement of public spaces) also have a low prominence but have a strong relationship value (i.e., driving factors).

Regarding the mobility cluster, the causes of blight were quickly agreed upon by the panel members, and the most significant ones within this cluster were selected by an almost unanimous vote. The following causes were chosen: parking problems (SC59), accesses (SC128), a lack of public transportation (SC131), public transportation conditions (SC132), and traffic (SC133). As shown in Fig. 8, traffic is the most prominent cause related to mobility. However, traffic presents weaker relationships with the other causes of blight (i.e., impact factor). Parking problems, in contrast, are quite prominent and strongly related to other SCs.

![DEMATEL cause-and-effect diagram for urbanism cluster](image6)

![DEMATEL cause-and-effect diagram for public spaces cluster](image7)
Fig. 8 DEMATEL cause-and-effect diagram for mobility cluster

(i.e., core factor), and public transportation conditions have a low relationship value and prominence (i.e., independent factor). Finally, a lack of public transportation and accesses have strong relationships but a low prominence (i.e., driving factors).

The economic context cluster considers economic crises (SC102), real estate speculation (SC103), a lack of public investment (SC105), extremely expensive rents (SC115), and the relocation of product-generating activities (SC119). Figure 9 confirms that a lack of public investment is distinguished from the other blight’s causes by not only having far stronger relationships but also being far less prominent (i.e., driving factor) than the other SCs. The remaining causes are reclassified as impact factors as they have weak relationships but a high prominence, except for economic crises, which have strong links (i.e., a core factor).

For the social context cluster, the SCs chosen were: social crises (SC73), precarious work conditions (SC74), low wages (SC77), unemployment (SC78), crime (SC84), home security (SC88), and overly high housing prices for family budgets (SC94). Figure 10 reveals that these causes of blight are present in only two quadrants. The core factors (i.e., low wages, unemployment, precarious work, and social crises) have strong relationships and a high prominence. The independent factors (i.e., overly high housing prices for family budgets, crime, and home security) have weak relationships and a low prominence.

Fig. 9 DEMATEL cause-and-effect diagram for economic context cluster
Finally, the public policy cluster contains the causes of blight that the panel members considered overall the most important: a lack of urban planning policies (SC120), a lack of renovation regulations (SC121), municipal programs of urban renovation and renewal (SC122), more housing policies (SC124), and the infrastructure to deal with catastrophes (SC126). As Fig. 11 shows, municipal urban renovation and renewal programs stand out as the most prominent, but their relationship value is low (i.e., an impact factor). The infrastructure to deal with catastrophes, in turn, also has a much lower relationship value, but this SC is also not particularly prominent. A lack of urban policies has strong relationships with the others, but it is the public policy SC with the lowest prominence (i.e., a driving factor), as is more housing policies. The final SC, a lack of renovation regulations has weak relationships and a low prominence (i.e., an independent factor).

The above analyses were followed by a validation session conducted with a neutral expert to validate and increase the proposed framework’s potential impact and versatility, and strengthen its results. This specialist was the head of the Territorial and Environmental Assessment and Monitoring Division of Cascais City Council Strategic Planning Department, Portugal.
4.3 Validation, discussion, and recommendations

The model developed, with the assistance of a panel specializing in blight, was subjected to dynamic cause-and-effect analyses to identify which causes are the most important, that is, the most closely related to—and influential in relation to—the other causes of blight. The results obtained were considered quite satisfactory in terms of the study’s main objective.

The final form and content of our map and DEMATEL diagrams were discussed with the panel members and represent the result of the negotiation and agreement reached by them. This discussion is important to legitimize the obtained results and improve validity of the framework developed. Naturally, the form and/or content of these maps/diagrams could have been different had the context or the participants involved been different or had the session lasted longer. However, context-dependence is an inherent characteristic of the cognitive mapping approach, which it is more than compensated by the direct involvement of experts, the amount of information discussed and by the iterative and interactive nature of the process. This allows ideas and thoughts to be shared and explored, and relationships between concepts to be better understood. From a constructivist perspective, this signifies that the analysis system created should be seen as a learning mechanism and not as an end in itself or a tool to prescribe optimal solutions.

Nonetheless, to complete the process, a validation session was scheduled with a specialist who had not participated in the first two sessions, and, therefore, who could be considered impartial regarding the model validation process, thereby ensuring greater consistency within the model and enhancing the results. This validation session also took place via the Zoom online platform.

The meeting was organized into four distinct phases. The session started with a brief summary of the topic and techniques used to provide a conceptual framework for the discussion and explain how the results were obtained. In the second phase, the expert was asked to comment on the results and techniques, after which she gave her opinion about the model’s strengths and weaknesses, as well as suggestions for possible improvement, in the third phase. Last, the interviewee was asked what would need to be done to integrate the proposed blight evaluation system into practice.

The specialist showed great interest in urban blight, the techniques applied and described particularly blighted areas within her city council. After the explanation of the techniques and process leading to the final results, she observed that “everything is very well structured, [...] the methodology is excellent” (in her words), and the results seem quite well organized, useful, and satisfactory. Thus, they could be implemented by not only large urban settings, but also, with the necessary adjustments, less urbanized areas or central government organizations. The specialist’s observations and reactions underlined the findings’ transparency and the ease with which the model can be interpreted, which adds greater empirical robustness to the analysis system.

When asked about the model’s strengths, the expert focused on three features. First, the methodology facilitates the reconciliation of qualitative and quantitative aspects. Second, the cognitive map’s extension included various causes in different clusters, which required much hard, time-consuming work. Last, despite the topic’s complexity, the model is easy to use and interpret. She also agreed with the most important indicators chosen by applying nominal group and multi-voting techniques and with the values assigned by the panel to the initial matrices during the second group session.

According to this expert, a weaknesses of this study is that other blight causes might have been identified if different specialists were recruited, and she noted that the number of panel members (i.e., six) seemed to be a limited number. These aspects reinforced the
necessity to acknowledge the study’s constructivist stance, which did not focus on achieving statistical representativeness and assumed, based on the extant literature, that the techniques’ application is valid with panels with 5 to 12 members (cf. Braga et al., 2021; Milici et al., 2021; Ferreira et al., 2022). The interviewee also mentioned that the SC of a lack of geographical information within the region is not currently of greater importance than some other indicators in the model, so this SC should not be considered directly linked to blight. This last point was the only suggestion of a specific way to improve the proposed model.

Regarding the model’s practical applicability, the expert asserted that this system could be an important advance in the field that should be integrated into city planners’ standards and that can help them achieve an ISO 37120 certification (i.e., sustainable development of cities). The analysis system could provide “important guiding principles for those who implement it” (citing her words), allowing decision makers to gain a fuller understanding of the topic and supporting decision-making processes. At the end of the session, the specialist added that, “in the future, the Cascais City Council would be very interested in expanding this work” (also in her words). This final session thus validated the system developed and the results in a real-life context. Although our results and observations are to some extent context-specific, they may be a valid starting point for other researchers and practitioners who strive to identify and prioritize causes of urban blight. Additionally, due to our process-oriented framework, the process followed can be replicated in other contexts/countries and/or with different groups of experts (cf. Bell & Morse, 2013; Ormerod, 2020).

5 Conclusion

Urban blight is a tangible problem in today’s contemporary society, drastically affecting not only specific neighborhood properties and living standards for residents, but also entire surrounding neighborhoods regarding levels of economic, social, and environmental viability and livability. Neighborhood blight can spread at an incredible speed. Thus, it must be prevented and eradicated as soon as it surfaces. If blight is allowed to reach a more advanced stage, it causes other serious problems such as drug and alcohol abuse or prostitution (Ernst, 2008; Ferreira et al., 2018; South et al., 2015), thereby contributing to rising crime rates (Darling, 1943; Haney, 2007; Picard, 1939; Weaver & Bagchi-Sen, 2013). Residents of blighted areas have lower qualities of life, including malaise and insecurity. They often find themselves in situations of greater physical and mental stress (Hosseini et al., 2017; Pearson et al., 2019; Picard, 1939; Valasik et al., 2019; Wagner, 2018). Therefore, it is not surprising that urban blight is increasingly being addressed by more recent studies, adding fuel to the debate around the blight phenomenon (Branas et al., 2016; Jones-Farmer & Hoerl, 2019; Mohamed et al., 2017; Wagner, 2018).

Research on urban blight is not an easy undertaking due to its complexity and subjectivity (Ernst, 2008; South et al., 2015). However, by assuming constructivist and complementary attitudes and using cognitive mapping and DEMATEL techniques, we were able to overcome some limitations of previous research. The results of this study include a model that incorporates qualitative and quantitative components to determine the causes of blight. This methodological combination facilitated the construction of a model different from those already available, resulting in a more transparent, complete design. The model integrates objective and subjective elements, as well as the perceptions and analyses of cause-and-effect relationships between the different criteria clusters and their most important indicators.
In addition, the results allow decision makers to understand where and how to intervene and what is the best investment and process to prevent blight from spreading or becoming an even more serious problem. The proposed methodology facilitates the identification of the causes of blight in a more transparent way through dialogues and discussions with and among decision makers. Also, this approach contributes to reducing the omission of key causes of blight and, consequently, resulting in a more complete model. Our study’s validation session verified that the proposed model helps experts understand blight better and identifies its causes and their internal hierarchy, thereby providing an excellent, easy-to-use tool to support decision making.

Given that no model is exempt from limitations, the following issues need to be mentioned, which arose despite the constructivist and complementary stance taken. First, due to subjective components, if the panel had been composed of other experts, other causes could have been detected. Second, although the methodologies used are flexible, the panel was made up solely of professionals from the Lisbon area. Third, the time gap between sessions due to COVID-19 noticeably may have affected the fieldwork. Last, the literature does not mention online sessions as falling within the normal scope of the techniques applied in this research. Therefore, it is unknow if delays caused by COVID-19 noticeably impacted overall results.

Our study evidently helped the experts who participated to understand urban blight and its causes better and allowed them to construct a model identifying how to prevent or mitigate blight based on analyses of cause-and-effect relationships among its causes. Identifying blight causes will be beneficial for planners and stakeholders to identify actions and scenarios that may prevent blight and offer perspectives on its eradication, thus contributing to a more equitable balance between the sustainability of the real estate market and the needs of society in general. In this sense, the proposed framework can be applied to urban environments, assisting stakeholders to avoid the deterioration of their neighborhoods and communities. In this regard, because land use policies play an important role in sustainable land cover change management, including addressing depopulation, real estate/neighborhood deterioration and lack of stakeholder participation and gentrification, our framework provides strategic support for development of urban blight prevention policies, greater public awareness, managing changes in practice, and active cooperation with societal stakeholders. This strengthens capability for long-term planning.

Nonetheless, the limitations presented above require further research addressing these issues. Futures studies could include: (1) similar research but with different panels; (2) parallel studies in other geographical locations; (3) research that makes use of online platforms; and (4) follow-up analyses of the proposed system involving practical implementations. Any advances made will ultimately strengthen the existing knowledge about the causes of blight, helping city planners to mitigate this phenomenon’s negative effects more fully.

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