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URBAN BLIGHT REMEDIATION STRATEGIES SUBJECT TO SEASONAL CONSTRAINTS

ABSTRACT

Urban blight is often defined as abandoned or poorly maintained real estate properties, often with overgrowth, trash-filled yards and alleys, graffiti, and broken windows. It has a detrimental impact on neighborhood safety and reputation. Blight also creates low-value areas in urban centers, reduces property values and business investment, and increases unemployment. These effects make urban blight an issue of growing interest as the need to eradicate blighted properties has significantly increased worldwide. This study adopted a constructivist, socio-technical stance that combined cognitive mapping, moving averages, and the decision-making trial and evaluation laboratory method. This methodological approach facilitated the identification of prevention strategies that control urban blight occurrences and subsequent eradication subject to seasonal constraints. Based on real-world cases, data was collected directly from a panel of urban blight experts. The members analyzed different prevention initiatives in terms of five major dimensions—governance, community involvement, economic context, territorial planning, and operations—which were previously identified during the development of a collective causal map. Practical applications of the proposed decision-support system were analyzed and validated by two independent experts from the *Direção Geral do Território* (General Directorate of the Territory of Portugal). No prior research was found that has adopted the proposed methodology to address urban blight. Recommendations facilitating the development of prevention strategies to eradicate urban blight are also provided.

Keywords: OR in societal problem analysis; Multiple criteria decision analysis; Cognitive mapping; Moving averages; Decision-making trial and evaluation laboratory (DEMATEL); Urban blight prevention; Real estate.

1. INTRODUCTION

Beers *et al.* (2011, p. 8) define urban blight as *"deteriorating property conditions that have deleterious effects on the community in which the property is situated"*. Occurrences of significant urban blight are generally associated with other negative socio-economic features, including a lack of public health and safety, poor neighborhood reputations, and depressed housing valuations. According to Ferreira *et al.* (2018), urban blight leads to critical problems such as drug and arms trafficking, prostitution, and diseases, which can have serious social and economic repercussions on the community at large. Thus, blight promotes adverse population outflows of individuals and families who prefer not to live in these conditions. An increasing neighborhood blight trend, in turn, develops into a serious issue for city and neighborhood councils because of declining property values, lower property tax revenues, low returns on real property investment, struggles with rising unemployment, and a progressive devaluing of local official authority.

Worldwide interest in identifying, preventing and eradicating blighted property has significantly increased in recent years. In broad terms, four categories of blight intervention strategies exist. The first is blight prevention, which relates to the implementation of existing laws and general rules that assume that strong code enforcement may be the most effective means to deter blight. The second blight intervention strategy is the acquisition/purchase of blighted properties to control occurrences of urban blight, while the third is disposition or the transfer of property for rehabilitation purposes. The last blight intervention strategy is to provide redevelopment incentives that seek to encourage private market investment in formerly blighted properties (Banaitienė *et al.*, 2008; Beers *et al.*, 2011; Hackworth, 2014; Mine, 2013; Redfearn, 2009; Smith, 2006).

The present study focused on the first intervention strategy (*i.e.*, blight prevention), where the issue of blight poses complex, wide-reaching negative impacts involving politicians, urban planners, contractors, financial institutions, investors, residents, and the community at large. Each of these stakeholders have different, often conflicting perspectives and objectives. Thus, blight prevention strategies need to be discussed and analyzed using a comprehensive, multiple-perspective, and inclusive approach (Banaitienė *et al.*, 2008; Ferreira *et al.*, 2018; Rutherford *et al.*, 2005). Given this scenario, the following interrelated questions remain unanswered:

- What are the most significant dimensions, determinants, and/or decision criteria to consider in analyses of urban blight prevention strategies?
- How can the dynamics of the cause-and-effect relationships between these multidimensions and/or decision criteria be analyzed when urban blight is subject to seasonal constraints defined by population flows?

To address these questions, the current study combined cognitive mapping and multiple criteria decision analysis (MCDA) to examine blight prevention strategies using real-world data.

This methodological approach facilitates added realism and displays unique and significant added value regarding international state-of-the-art of blight prevention practices. The use of cognitive mapping brings new insights to analyses based on expert knowledge, which would not be uncovered using statistical methods alone (Belton & Stewart, 2002; Pereira *et al.*, 2020). Incorporating moving averages (MAs) into the group decision-making trial and evaluation laboratory method (*i.e.*, group DEMATEL—an MCDA approach to understanding the nonlinear behavior of complex system cause-and-effect relationships (Gabus & Fontela, 1972)) also fosters more informed and conscious decision making based on variable-change analysis subject to seasonal constraints. In this context, urban blight is clearly shaped by seasonal population flows (Sun *et al.*, 2019). Despite the relative popularity of cognitive mapping and DEMATEL, the literature provides no evidence of this combined application in prior analyses of blight prevention strategies. The novelty of the proposed approach is also due to the integration of MA into DEMATEL, which generated a new DEMATEL-based algorithm (*i.e.*, MA-DEMATEL) in a seasonally constrained model. Uniquely combining cognitive mapping and MA-DEMATEL increases flexibility and comprehensiveness in solving complex decision problems. Procedural steps followed by this methodology focus on supporting interactive learning and a fruitful elaboration of recommendations for blight prevention strategies. From a constructivist perspective, the decision-support system provided in this study should be understood as being process-oriented rather than as an end in itself or as a tool allowing experts to prescribe optimal solutions (*cf.* Ackermann, 2019; Bell & Morse, 2013; Ormerod, 2013, 2018). The current results can also complement previous studies involving analyses of blight issues and respective impacts on communities. The aim is not to substitute previous methods or techniques but instead to augment their scope.

In summary, we believe that our study produces important theoretical and practical contributions to this highly specialized literature. Although our findings are idiosyncratic in nature, in theory they can be an important starting point for other researchers and practitioners who analyze blight prevention practices. Thus, our addition to the literature complements previous contributions in the field and is available as a springboard for additional studies. From a methodological viewpoint, our contributions are two-fold. First, we combine methodologies (*i.e.*, cognitive mapping and DEMATEL), which we believe to be a novel approach in the analysis of urban blight remediation strategies. Additionally, this includes the integration of MA into group DEMATEL, which facilitates the development and application of a new algorithm (*i.e.*, MA-DEMATEL), fostering more informed and conscious decision making based on variable-change analysis subject to seasonal constraints. Second, our contribution is derived from the description of the applied process, which allows for replications in different contexts and/or with different groups of experts. This results from the process-oriented nature of the framework.

The remainder of this paper is organized as follows. Section two presents a literature review focused on urban blight, its impacts, and possible prevention strategies. Section three provides the methodological background, justifying the use of cognitive mapping and MA-DEMATEL in this research context. Section four describes the procedures followed to develop a structured understanding of blight prevention strategies, as well as discussing the results and limitations of the dynamic analysis system created. The last section details the advantages and limitations of the proposed framework, and lays out a roadmap for future research.

2. OVERVIEW OF URBAN BLIGHT, RESEARCH GAPS, AND STUDY NOVELTY

Defining urban blight is not easy (Hoffman, 2012). Darling (1943) introduced the term in 1943 to refer to real estate properties that are neglected and inhabited by people whose standard of living is below their society's average. Thus, blighted areas tend to have inadequate housing characterized by limited living areas, poorly maintained properties with deficient lighting and air quality. Although many conceptualizations of urban blight have been developed over the years (*e.g.*, Banaitienė *et al.*, 2008; Beers *et al.*, 2011; Ferreira *et al.*, 2018; Hackworth, 2014; Mine, 2013; Redfearn, 2009; Smith, 2006; Sun *et al.*, 2019), most have focused on the characteristics, causes, and consequences of this unfavorable social phenomenon, without offering a generally accepted definition of blight. For instance, Beers *et al.* (2011) use the term "abandoned" as synonymous with "blighted", but "abandoned" and "blighted" have different meanings. Blight is normally considered a more comprehensive concept because, in addition to abandoned properties, it includes inhabited properties with unlivable conditions (*cf.* Data Science for Social Good (DSSG), 2014). Figure 1 provides two examples of urban blight.

Figure 1. Real-life Examples of Blighted Properties

Source: Own illustration.

Although a widely accepted definition of urban blight has yet to be presented, the importance of this social phenomenon seems to be clear. Different studies show how blighted properties affect local populations, cities are changed because of blighted neighborhoods, or changing tax systems softens or aggravates urban blight (see, for example, Haney (2007), Whitaker and Fitzpatrick IV (2013), and Hosseini *et al.* (2017)).

Ferreira *et al.* (2018) underline the importance of analyzing blight, noting that blight tends to diminish the quality of life for those living in blighted properties and neighborhoods, especially for children. Salas and Yepes (2018), Lousada *et al.* (2021), and Sun *et al.* (2019) also note that blight may affect entire neighborhoods as this issue often leads to more real estate disfigurement. Blight is frequently associated with drug trafficking, prostitution, and other crimes, thereby severely impacting residents' perceived and actual safety.

According to Marques *et al.* (2018), Sun *et al.* (2019) and Barão *et al.* (2021), blight-caused household migrations aggravate changes in property values that, in turn, is an endogenous factor affecting neighborhood socio-economic composition. Blight can also lead to increased costs for services delivery, such as police, fire fighters, and solid waste removal services, further exacerbating property value losses beyond what would be expected from depreciation alone (Baker, 2011; Fernandes *et al.*, 2018; Hsu & Juan, 2016). This trend becomes a serious issue for decision makers (*e.g.*, real estate investors, and city and neighborhood councils), who fail to detect blight trends that result in reduced returns on their investment, and communities struggling with rising unemployment, out migration and property devaluation (Pires *et al.*, 2018; Reis *et al.*, 2019; Ribeiro *et al.*, 2017). Thus, urban blight tends to destabilize entire neighborhoods and communities, often resulting in a seasonal exodus from affected areas (DSSG, 2014; Ferreira, 2016; Ferreira *et al.*, 2018; Picard, 1939; Turcu, 2012).

Urban blight can be characterized as a multidimensional complex decision problem exacerbated by seasonal population flows (*cf.* Jauhiainen & Mönkkönen, 2005; Sun *et al.*, 2019), and may result from varied circumstances, including economic crises, urban sprawl, inadequate urban planning, or seasonal variations in temperature, daylight, fauna, and landscape. Also, temporal challenges, including natural seasonal changes, may cause differences in functional land use. As a result, unwarranted socio-economic and cultural patterns, including a lack of social and physical infrastructure, accelerate both the biophysical environment and the blight process in a seasonal pattern. Jauhiainen and Mönkkönen (2005, p. 280) note that *"seasonality is a particularly significant organizer of human activities"* that offers incentives for discussions regarding how seasonal factors are—or should be—reflected in modern urban planning.

In general, the literature agrees with both urban blight's broad negative impacts and the need for intervention, remediation, and/or prevention strategies. Beers *et al.* (2011), Sun *et al.* (2019), and White (1986) report that various economic, technical, qualitative, and infrastructural initiatives have been developed to address this issue. These strategies include, among others, sales tax reforms and abatements, the elimination of post-sale redemptions, codes governing real estate property administration and rehabilitation, the discouragement of distressed property speculation, and district level improvements. However, studies addressing urban blight prevention strategies directly are quite rare (*cf.* Ferreira *et al.*, 2018; Sun *et al.*, 2019). In addition, most research carried out thus far suffers from basic limitations, such as a lack of clarity regarding how the dimensions, determinants, and/or decision criteria are identified and operationalized in analyses of urban blight remediation and/or prevention strategies (*cf.* Faria *et al.*, 2018). Also, blight-related studies mention a scarcity of dynamic analyses focusing on cause-and-effect relationships between dimensions/determinants of urban blight (Assunção *et al.*, 2020; Lousada *et al.*, 2021).

Statistical models are by far the most popular methodological approach for addressing real estate decision problems, but these models require rigorous distribution assumptions and data with particular scaling properties, offering limited flexibility (*cf.* Assunção *et al.*, 2020; Dobrovolskienė *et al.*, 2019; Marques *et al.*, 2020). In addition, correlations generally fail to indicate causality, so the existing models and analyses of complex urban blight situations require critical examinations of causal relationships between dimensions and determinants of urban blight. These shortcomings strengthened the motivation to adopt a constructivist, socio-technical approach and to use cognitive mapping and DEMATEL in the present study.

Four major factors influenced the selection of methods in the present study. First, cognitive mapping and DEMATEL are two well-established socio-technical methods recognized as being simple to apply and facilitating decision making across various organizational contexts (*cf.* Belton & Stewart, 2010; Doukas & Nikas, 2020). Second, two of DEMATEL's key features are the capacity to include qualitative and quantitative criteria and deal with the interdependence between them during analyses of cause-and-effect relationships. Third, moving averages can be easily integrated into DEMATEL matrices, allowing seasonal effects to be modeled. Last, despite cognitive mapping and DEMATEL's relative popularity, their combined use is quite scarce, and the literature offers no prior evidence of their combined used in this study context, supporting the assumption that the proposed framework is a novelty in the field of urban blight prevention.

Based on cognitive mapping and the MA-DEMATEL approach, this study provides a more structured, precise means of identifying and analyzing blight prevention strategies. According to Freedman and Owens (2011, p. 115), the timely, accurate identification of blight prevention initiatives can have significant consequences. Specifically, as the authors state, *"when well-planned and targeted, subsidized housing development may revitalize struggling communities and generate positive externalities that help to turn declining neighborhoods around"*.

3. BRIEF METHODOLOGICAL BACKGROUND

3.1 Cognitive Mapping

Cognitive mapping is a problem structuring method (PSM) (Ackermann & Eden, 2001; Belton & Stewart, 2002; Rosenhead, 2013; Smith & Shaw, 2019) that supports the configuration of complex decision problems. This method *"was developed as a tool to help understand how different people involved in a situation made sense of it, or understood it, for themselves"* (Mingers, 2008, p. 6). Supported by a constructivist epistemological stance, this type of map can take diverse visual, interactive forms, helping individuals materialize and share their knowledge, experiences, and ideas, while promoting group discussions. From a practical point of view, a cognitive map is defined as a network of concepts or nodes and links or arrows in which the arrows' direction implies perceived causality between nodes (Eden, 2004). Causal relationships are usually accompanied by a positive (+) or negative (–) sign, depending on the type of influence the first item has on the second item (Assunção *et al.*, 2020; Faria *et al.*, 2018). *"Sometimes cognitive maps are known as 'cause* [or causal] *maps', particularly when they are constructed by a group* […]*"* (Eden, 2004, p. 673).

Although subjective in nature and strongly dependent on participants' willingness, openness, and availability, the added value generated by using cognitive mapping as a PSM has been widely reported in the literature (*cf.* Eden, 2004; Miguel *et al.*, 2019). Howick and Eden (2011), Montibeller and Belton (2006), and Tegarden and Sheetz (2003), among many others, note that cognitive mapping provides decision makers with a deeper understanding of the cause-and-effect links between decision criteria. Also, cognitive mapping enhances group work and allows objective and subjective decision criteria to be integrated into decision-making processes, as well as facilitating the definition of strategic guidelines and formulation of improvement initiatives.

Due to its interactivity, versatility, and simplicity (*cf.* Castanho *et al.*, 2019; Marques *et al.*, 2018), cognitive mapping is generally considered a valuable decision-support tool in three ways. These are: (1) promoting greater involvement of decision makers in decision-making processes; (2) reducing the number of criteria omitted; and (3) guiding the learning process by leading decision makers toward a deeper understanding of the causal relationships between decision criteria (Faria *et al.*, 2018; Mackenzie *et al.*, 2006). Given these features, the present study applied cognitive mapping techniques to define and structure blight prevention strategies, after which MA and DEMATEL were combined to analyze the dynamics of the cause-and-effect relationships identified in the group causal map generated.

3.2 MA-DEMATEL

DEMATEL was originally developed in the 1970s by the Battelle Memorial Institute of Geneva's Science and Human Affairs Program to study complex group decision problems (Gabus & Fontela, 1972). This approach facilitates the grouping of decision criteria into categories of causes and effects, thereby further clarifying the cause-and-effect relationships between these criteria (Kannan, 2021; Govindan et al., 2021)..

As discussed previously, the urban blight issue is influenced by population flows, which, in turn, are marked by irregular seasonality (Oliveira *et al.*, 2018; Sun *et al.*, 2019). The incorporation of MA into group DEMATEL (*i.e.*, MA-DEMATEL) fosters more informed and conscious decision making based on variable-change analysis subject to seasonal constraints. Table 1 presents the MA-DEMATEL algorithm adopted in the present study.

Table 1. Description of MA-DEMATEL Algorithm

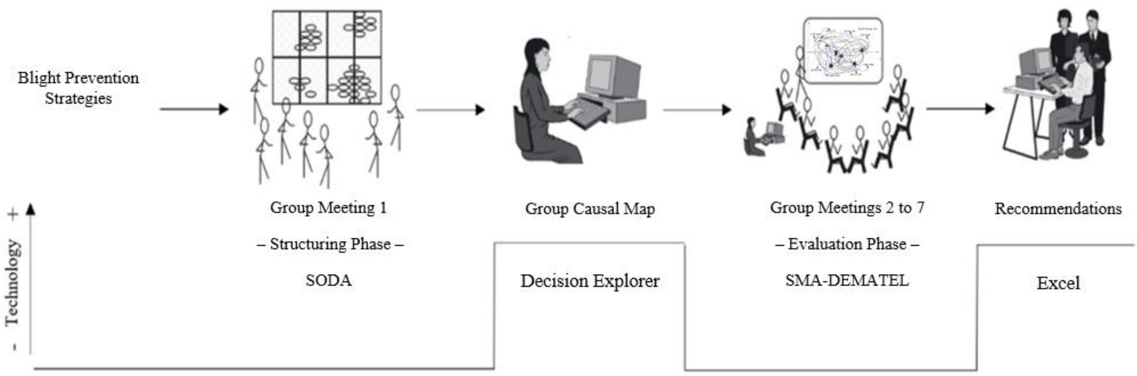
Step 1. Gather experts' opinions and obtain the initial matrices Z_0, Z_1, and Z_2. A group of *m* experts and *k* criteria are used in this step.
Step 2. Collect experts' opinions and calculate the MA matrix Z_i for period t_i, with $i = 3, \ldots, 5$: $$F_t = \frac{x_{ij}^{t-1}+x_{ij}^{t-2}+\cdots+x_{ij}^{t-n}}{n}$$ in which F_t is the forecast for the coming period, *n* is the number of periods to be averaged, and x_{ij}^{t-1} is the actual intensity of criterion C_i's impact on criterion C_j in the past period for up to *n* periods.
Step 3. Calculate the normalized initial direct-relation matrix *D*: $$D = \lambda * Z \Leftrightarrow [d_{ij}]_{nxn} = \lambda\ [z_{ij}]_{nxn}$$ in which $$\lambda = \text{Min}\ [\frac{1}{\max_{1\leq i\leq n} \sum_{j=1}^{n} \lvert z_{ij}\rvert}, \frac{1}{\max_{1\leq i\leq n} \sum_{i=1}^{n} \lvert z_{ij}\rvert}]$$ Based on Markov chain theory, D^m is the power of matrix *D* (*e.g.*, D^2, D^3, …, D^∞), which guarantees convergent solutions to the matrix inversion: $$\lim_{m\to\infty} D^m = [0]_{nxn}$$
Step 4. Derive the total-relation matrix *T*, which reflects the total relationship between each pair of criteria: $$T=\sum_{m=1}^{\infty} D^i$$
Step 5. Calculate the sums of matrix *T*'s rows and columns. In the total-influence matrix *T*, the sums of rows and columns are represented by vectors *r* and *c*, respectively: $$r = [r_i]_{nx1} = \left(\sum_{j=1}^{n} t_{ij}\right)_{nx1}$$ $$c = [c_j]'_{1xn} = \left(\sum_{j=1}^{n} t_{ij}\right)'_{1xn}$$ in which $[c_j]'$ is denoted as the transposition matrix.
Step 6. Set a threshold value (α) that seeks to eliminate minor effect elements in matrix *T*: $$\alpha = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n}[t_{ij}]}{N}$$ in which *N* is the total number of elements in matrix *T*.
Step 7. Build a cause-and-effect relationship diagram.

As mentioned previously, the novelty of the proposed methodology is also due to the integration of MA into group DEMATEL, which allows for the modeling of seasonality constraints.

According to Marttunen *et al.* (2017), some of the most common reasons for combining MCDA methods, and/or using mixed methods in general, are to: (1) help decision makers understand, delineate and organize decision problems; (2) facilitate the development of a comprehensive set of decision criteria and sub-criteria (*i.e.*, blight prevention strategies and initiatives in our case); (3) assess their significance by calculating their centrality and domain; and (4) stimulate new causal thinking. A precondition necessary for success is that the facilitator or facilitators are familiar with the applied methodology and are fully involved throughout the whole process (Belton *et al.*, 1997; Ferreira and Santos, 2016, 2018) (for further discussion on the issues/benefits of using mixed methods, see also Belton and Stewart (2010), Ferreira *et al.* (2011), Howick and Ackermann (2011) and Zavadskas *et al.* (2014)). The procedural steps followed in this study are intended to encourage interactive learning and a richer set of recommendations for how to prevent urban blight.

4. PROCESS DEVELOPMENT

Cognitive mapping and DEMATEL have been intensively applied in different decision-making contexts, and studies using each technique individually have demonstrated their potential as decision-support tools. Their combined use, however, is quite scarce, and no documented evidence was found of a prior integrated use in this specific study context, supporting the conclusion that the proposed framework constitutes an innovation. Figure 2 presents the methodological procedures followed in this research.



Note. SODA = strategic options development and analysis; SMA = simple moving average.

Figure 2. Methodological Procedures Followed

Source: Adapted from Ackermann and Eden (2010)

As shown in Figure 2, the procedures were organized into three main phases (Belton & Stewart, 2002). The first phase was the structuring phase, which comprised cognitive mapping using the strategic options development and analysis (SODA) approach (Eden & Ackermann, 2001). This technique facilitated the identification of different blight prevention initiatives and the organization of these decision criteria into clusters/areas of concern. The second phase was the evaluation phase, which focused on applying MA-DEMATEL to analyze the dynamics of cause-and-effect relationships between blight prevention strategies and initiatives (*i.e.*, possible causal loops and the way decision criteria evolve individually or collectively over time), and thus the categorization of these clusters and decision criteria. To complete this phase, 6 group meetings were organized every 4 months over a 2-year period, which allowed seasonal perceptions to be modeled. In the last phase of recommendations, suggestions were made regarding how to develop appropriate prevention strategies for urban blight elimination. The application of these phases is detailed in the following sections.

4.1 Structuring Phase

Blight is a complex decision problem where resolution requires community engagement and both collective and individual initiatives. In this study, the knowledge and experience of a varied group of stakeholders were used to map the problem and better understand occurrences of blight. The foundational empirical research was carried out over a 24-month period, including several informal and/or unstructured individual interviews with city planners and urban architects from the city of Lisbon, Portugal. Initial interviews took place over a 3-month period and were not (directly) used to develop the causal map. Still, they were important to provide deeper initial conceptualizations of blight consequences and prevention strategies, and additionally to refine the trigger question presented to the expert panel members during the first group meeting. The research also required group meetings to construct a collective causal map and analyze cause-and-effect relationships between blight prevention strategies using the MA-DEMATEL approach.

4.1.1 Participants

The participants were carefully selected to ensure a variety of technical perspectives regarding urban blight and different prevention strategies. Thus, the decision-maker panel included urban architects, civil engineers, representatives of homeowner associations, and senior city planners within the Lisbon city council. All the participants had decision-making power and occupied positions of responsibility in both in the public and private sector. Additional crucial considerations were the panel members' heterogeneity in terms of age (*i.e.*, between 40 and 55 years old), gender (*i.e.*, four men and three women), work experience, and their availability to attend group meetings.

The final decision-maker panel included 7 members, as Eden and Ackermann (2004, p. 618) suggest that these groups *"should have between 6 and 10 key individuals"*. Although the results of this study reflect the ideas and experience of this particular group of participants, the procedures followed—when correctly employed—can work equally well with different decision-maker panels or in other contexts. This generalizability is a reflection of the constructivist, process-oriented orientation adopted since the proposed methodology is more focused on process than on specific desired outcomes (for further discussions, see Bell and Morse (2013), Ormerod (2013, 2018), and Ackermann (2019)). An experienced facilitator (*i.e.*, one of the authors of this paper) was in charge of conducting the group meetings and recording the outcomes.

4.1.2 Group Causal Map

After detailed explanations of the decision problem to be addressed and the methodologies to be applied, the operational phase of the first panel meeting started with the following trigger question: *"Based on your practical experience, what prevention strategies and/or initiatives would you suggest that can eliminate urban blight?"*. The "post-its technique", associated with the SODA approach, was applied next (Ackermann & Eden, 2001). This technique consists of writing relevant decision criteria—in this case, dimensions and determinants of blight prevention strategies—on post-it notes and sticking them on large sheets of white paper to produce decision criteria clusters.

According to Faria *et al.* (2018) and Marques *et al.* (2020), basic guidelines are that only one criterion can appear on each post-it note, and that the clusters are interpreted as "areas of concern (or intervention)". Group dynamics and negotiations are quite important in this exercise because the procedures followed allow individuals to encounter different ideas and experiences, and reach more consensual perceptions of the blight issue and prevention strategies. Assunção *et al.* (2020) and Belton and Stewart (2002), among others, report that the interactive nature of PSMs in general, and cognitive mapping in particular, allows decision makers to access decisional dimensions that would not be possible to reach in other ways. This happens since cognitive mapping comprises both objective and subjective components, promotes the exchange of ideas and experiences, boosts a deeper understanding of decision situations, and uncovers cause-and-effect relationships among decision criteria. Also, Belton and Stewart (2002) and Eden (2004) find that this facilitates answers to questions such as "why does this happen?". Thus, cognitive mapping application by managers and decision makers may provide insights on key feedback loops in the system, which might otherwise go undetected by statistical approaches alone.

"Simple" visual representations of information and knowledge have been identified as an essential dimension of cognitive mapping-based approaches to support decision making (*cf.* Eden & Ackermann, 1998). However, clusters of decision criteria can be identified based on their density and centrality (Eden, 2004). Therefore, the decision makers involved in our study considered the density and centrality of clusters in identifying areas of concern, which are critical and play a fundamental role as catalysts for the development of blight prevention strategies.

The participants were asked to focus their collective attention on one cluster at a time in order to define hierarchies within the clusters of decision criteria. This procedure elicited further discussion among the panel members and facilitated the identification of cause-and-effect relationships between blight prevention initiatives. A group causal map was subsequently constructed using the panel's findings and the *Decision Explorer* software (http://www.banxia.com). The map was validated by the group as a result of further group discussion, and the final version is presented in Figure 3 (size restrictions prevent a better visualization, but an editable version of the entire group causal map can be obtained from the corresponding author upon request).

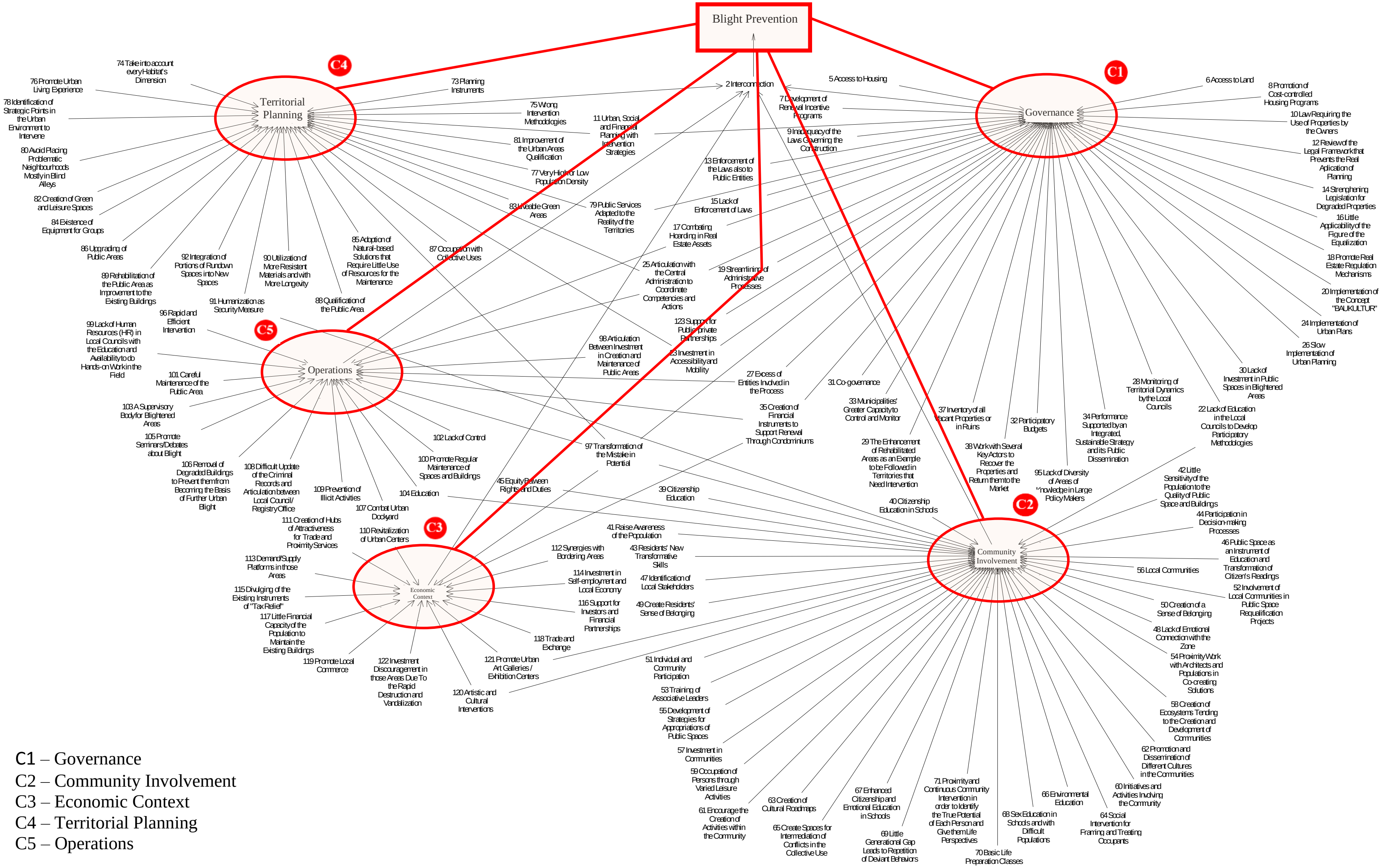


Figure 3. Group Causal Map

The panel's subjective perceptions were used to construct the causal map. Thus, the final map could have been different had the sessions lasted longer or the participants involved been different—including the facilitator (*cf.* Bell & Morse, 2013). However, situation-specific results reflect the cognitive mapping's constructivist and process-focused nature, and its ability to incorporate—rather than negate—decision making's inherent subjectivity (Keeney, 1992, 1994). Overall, the creation of the collective causal map was useful in terms of both structuring and improving the panel's understanding of blight prevention strategies.

The process resulted in blight prevention initiatives being allocated to five major clusters (*i.e.*, dimensions or areas of concern): governance (C1); community involvement (C2); economic context (C3); territorial planning (C4); and operations (C5). As reported in the literature (*e.g.*, Eden & Ackermann, 2001; Jalali *et al.*, 2016), cognitive mapping also significantly reduced omitted dimensions and determinants of blight prevention strategies, and facilitated the panel's understanding of the cause-and-effect relationships between different decision criteria. This was possible because the mapping process simulated learning and allowed different expert opinions to be formally projected, creating a holistic framework within which decision criteria and their cause-and-effect relationships could be detected and understood. Additionally, due to its recursive nature, the mapping process provided (new) insights on urban blight resulting from the participants being encouraged to further discuss possible prevention strategies and promoting a better understanding of associated actions and initiatives. Also, this discussion allowed other important decision criteria to be "uncovered", thus fostering informed decision making. The mapping process was fundamental to the subsequent successful completion of the evaluation phase, in which MA-DEMATEL was applied.

4.2 Evaluation Phase

To apply the MA-DEMATEL algorithm (see Table 1), and model seasonal perceptions regarding blight prevention strategies, 6 group meetings were organized every 4 months over a 2-year period. The group analyzed the degree to which relationships among elements in each matrix influence the respective determinants. The classic DEMATEL scale was used (*i.e.*, 0 = no influence; 1= very low influence; 2 = low influence; 3 = high influence; and 4 = very high influence), with decimal scores allowed (Gabus & Fontela, 1972).

The first 3 matrices Z_t (*i.e.*, Z_0, Z_1, and Z_2) show data gathered directly from the panel members after intense group discussion and negotiation, where C_i represents the decision criterion and/or dimension i and t stands for the respective period of time (*i.e.*, every 4 months) (see Step 1 in Table 1). The remaining matrices (*i.e.*, Z_3, Z_4, and Z_5) were completed based on the calculation of MAs in base-3 (see Step 2 in Table 1). Because we used MAs in base-3, three initial matrices were needed to do the calculi. Each initial matrix corresponds to a different period (*i.e.*, t_0, t_1 and

t_2). With these three initial matrices, we then calculated the average values for matrix Z_3. Subsequently, we then used the values of matrices Z_1, Z_2 and Z_3 to calculate Z_4 (and so on), using MAs in base-3. All matrices were discussed collectively and validated by the group. As with previous steps, group dynamics were important because they allowed individuals to encounter contrasting perceptions, analyze the MA values, and reach more consensual conclusions, as shown in the following matrices:

$$Z_0 = \begin{array}{c} \\ C1 \\ C2 \\ C3 \\ C4 \\ C5 \end{array} \begin{array}{c} \begin{array}{ccccc} C1 & C2 & C3 & C4 & C5 \end{array} \\ \begin{pmatrix} 0.00 & 2.00 & 2.50 & 4.00 & 3.50 \\ 1.50 & 0.00 & 0.50 & 2.00 & 2.00 \\ 2.00 & 3.00 & 0.00 & 3.00 & 3.00 \\ 2.00 & 3.00 & 3.00 & 0.00 & 2{,}50 \\ 2.00 & 4.00 & 4.00 & 3.00 & 0.00 \end{pmatrix} \end{array}$$

$$Z_1 = \begin{array}{c} \\ C1 \\ C2 \\ C3 \\ C4 \\ C5 \end{array} \begin{array}{c} \begin{array}{ccccc} C1 & C2 & C3 & C4 & C5 \end{array} \\ \begin{pmatrix} 0.00 & 2.25 & 2.50 & 4.00 & 3.75 \\ 1.75 & 0.00 & 0.50 & 2.50 & 2.25 \\ 2.00 & 3.00 & 0.00 & 3.25 & 3.00 \\ 2.00 & 3.15 & 3.00 & 0.00 & 2.75 \\ 2.25 & 4.00 & 4.00 & 3.00 & 0.00 \end{pmatrix} \end{array}$$

$$Z_2 = \begin{array}{c} \\ C1 \\ C2 \\ C3 \\ C4 \\ C5 \end{array} \begin{array}{c} \begin{array}{ccccc} C1 & C2 & C3 & C4 & C5 \end{array} \\ \begin{pmatrix} 0.00 & 2.50 & 3.00 & 4.00 & 3.75 \\ 2.00 & 0.00 & 0{,}50 & 2.75 & 2.50 \\ 2.25 & 3.25 & 0.00 & 3.50 & 3.00 \\ 2.00 & 3.25 & 3.25 & 0.00 & 3.00 \\ 2.25 & 4.00 & 4.00 & 3.25 & 0.00 \end{pmatrix} \end{array}$$

$$Z_3 = \begin{array}{c} \\ C1 \\ C2 \\ C3 \\ C4 \\ C5 \end{array} \begin{array}{c} \begin{array}{ccccc} C1 & C2 & C3 & C4 & C5 \end{array} \\ \begin{pmatrix} 0.00 & 2.25 & 2.67 & 4.00 & 3.67 \\ 1.75 & 0.00 & 0.50 & 2.42 & 2.25 \\ 2.08 & 3.08 & 0.00 & 2.25 & 3.00 \\ 2.00 & 3.13 & 3.08 & 0.00 & 2.75 \\ 2.17 & 4.00 & 4.00 & 3.08 & 0.00 \end{pmatrix} \end{array}$$

$$Z_4 = \begin{array}{c} \\ C1 \\ C2 \\ C3 \\ C4 \\ C5 \end{array} \begin{array}{c} \begin{array}{ccccc} C1 & C2 & C3 & C4 & C5 \end{array} \\ \begin{pmatrix} 0.00 & 2.33 & 2.72 & 4.00 & 3.72 \\ 1.83 & 0.00 & 0.50 & 2.56 & 2.33 \\ 2.11 & 3.11 & 0.00 & 3.33 & 3.00 \\ 2.00 & 3.18 & 3.11 & 0.00 & 2.83 \\ 2.22 & 4.00 & 4.00 & 3.11 & 0.00 \end{pmatrix} \end{array}$$

$$Z_5 = \begin{array}{c} \\ C1 \\ C2 \\ C3 \\ C4 \\ C5 \end{array} \begin{array}{c} \begin{array}{ccccc} C1 & C2 & C3 & C4 & C5 \end{array} \\ \begin{pmatrix} 0.00 & 2.36 & 2.80 & 4.00 & 3.71 \\ 1.86 & 0.00 & 0.50 & 2.57 & 2.36 \\ 2.15 & 3.15 & 0.00 & 3.36 & 3.00 \\ 2.00 & 3.19 & 3.15 & 00.0 & 2.86 \\ 2.21 & 4.00 & 4.00 & 3.15 & 00.0 \end{pmatrix} \end{array}$$

The normalized initial direct-relation matrix D_5 was then calculated based on Z_5 (see Step 3 in Table 1):

$$D_5 = \begin{pmatrix} 0.0000 & 0.1767 & 0.2093 & 0.2994 & 0.2779 \\ 0.1393 & 0.0000 & 0.0374 & 0.1927 & 0.1767 \\ 0.1608 & 0.2356 & 0.0000 & 0.2516 & 0.2245 \\ 0.1497 & 0.2385 & 0.2356 & 0.0000 & 0.2141 \\ 0.1656 & 0.2994 & 0.2994 & 0.2356 & 0.0000 \end{pmatrix}$$

The total-relation matrix T_5 was calculated as shown below (see Step 4 in Table 1):

$$T_5 = \begin{pmatrix} 0.7636 & 1.2685 & 1.1084 & 1.3460 & 1.2514 \\ 0.5882 & 0.6827 & 0.6170 & 0.8390 & 0.7790 \\ 0.8236 & 1.1944 & 0.8310 & 1.1982 & 1.1076 \\ 0.7913 & 1.1607 & 0.9907 & 0.9612 & 1.0674 \\ 0.9012 & 1.3449 & 1.1499 & 1.2950 & 1.0236 \end{pmatrix}$$

The sums of rows and columns in matrix T_5, according to Step 5 in Table 1, are shown in Table 2, in which the value of α is 1.0034 (see Step 6 in Table 1).

Table 2. Sums Given and Received among Clusters/Dimensions t_5

	C1	**C2**	**C3**	**C4**	**C5**	**R**	**R+C**	**R-C**
C1	0.7636	1.2685*	1.1084*	1.3460*	1.2514*	5.7380	9.6059	1.8700
C2	0.5882	0.6827	0.6170	0.8390	0.7790	3.5058	9.1569	-2.1452
C3	0.8236	1.1944*	0.8310	1.1982*	1.1076*	5.1547	9.8516	0.4578
C4	0.7913	1.1607*	0.9907	0.9612	1.0674*	4.9714	10.6109	-0.6681
C5	0.9012	1.3449*	1.1499*	1.2950*	1.0236*	5.7145	10.9435	0.4855
C	3.8679	5.6511	4.6969	5.6395	5.2290	–	–	–

The values t_{ij} presented in Table 2 that are greater than α (1.0034) are identified as t_{ij}^* (*e.g.*, the value of t_{12} (1.2685) > α (1.0034)), such that C1 causes C2). Figure 4 compares the positioning of the clusters at moments t_0 and t_5.

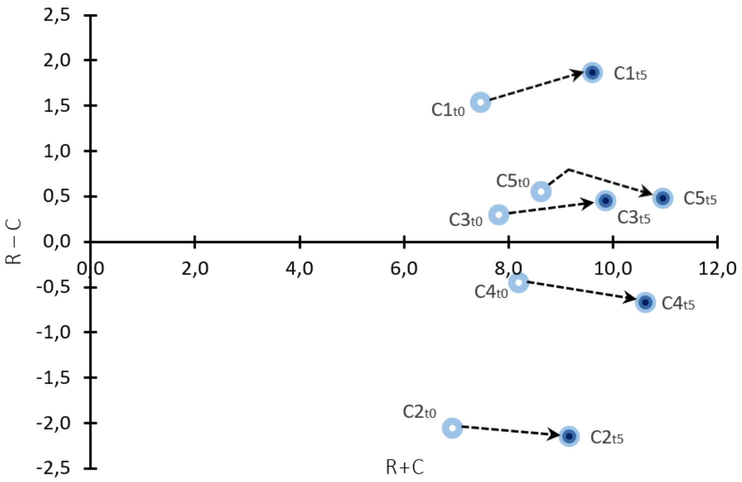


Figure 4. Clusters' Positioning over Time $t_0 \rightarrow t_5$

As described previously, the clusters' dynamic movements were modeled using MAs in base-3, which allowed blight seasonal effects to be considered in the blight prevention strategies analysis. At this stage of the process, the panel members were asked to focus on the last position of the clusters at t_5 and analyze the cause-and-effect relationships among them. The cause-and-effect diagram of the five clusters/dimensions, analyzed at moment t_5, is presented in Figure 5 (see Step 7 in Table 1).

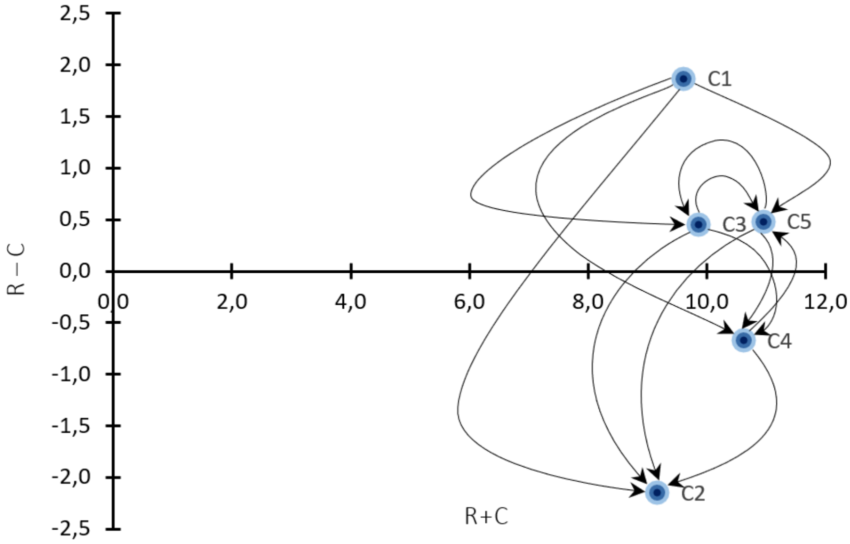
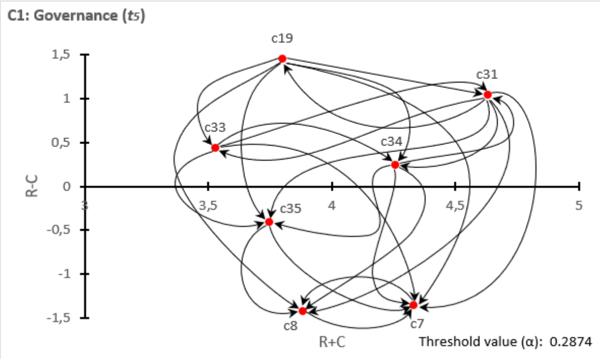


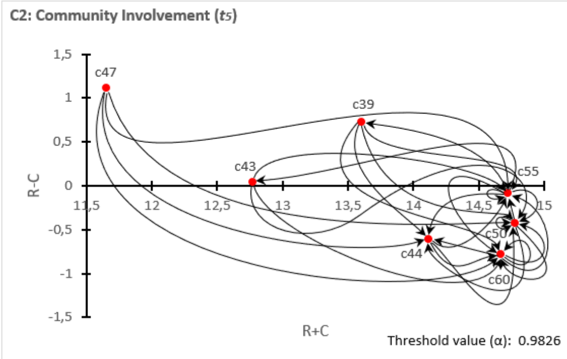
Figure 5. Cause-and-effect Relationships Among Clusters at t_5

As can be seen in Figure 5, the MA-DEMATEL application revealed that all clusters/dimensions can be considered significant approaches for preventing occurrences of urban blight. However, because each cluster represents an area of concern and contains different blight prevention strategies and initiatives when compared to the other clusters, special emphasis should be attributed to the territorial planning and operations clusters (C4 and C5, respectively) due to the scores obtained in the R+C axis. Based on the panel members' collective evaluations, the governance cluster (C1) was also identified as the cause of all the other blight prevention initiatives, since it directly affects all the other dimensions (C2 to C5). Community involvement (C2), in turn, is directly influenced by all other clusters, thus the panel considered this an effect cluster. Although many preventive initiatives included in C2 can have a direct impact on urban blight prevention, the panel members agreed that community involvement and related initiatives are a result of the schemes developed as part of the remaining intervention dimensions. This perception is reinforced by the literature, which finds that community involvement is a direct result of strong code enforcement meant to deter blight (*cf.* Sun *et al.*, 2019).

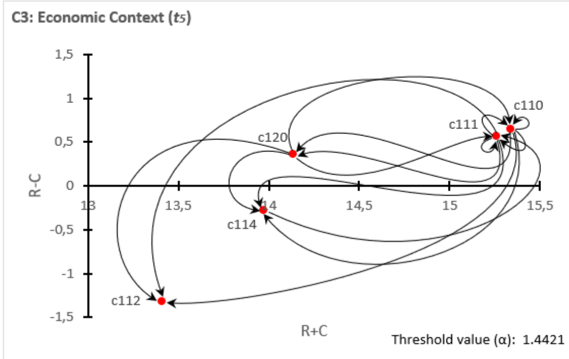
The next step of the process was intra-cluster analyses, in which the most significant determinants within each cluster/dimension were identified based on group discussions. The seven steps of the MA-DEMATEL algorithm presented in Table 1 were again applied to facilitate the intra-cluster analyses. Again, all diagrams were developed in close interaction with the expert panel members and validated by them during group discussion and negotiation. Figure 6 presents the results.



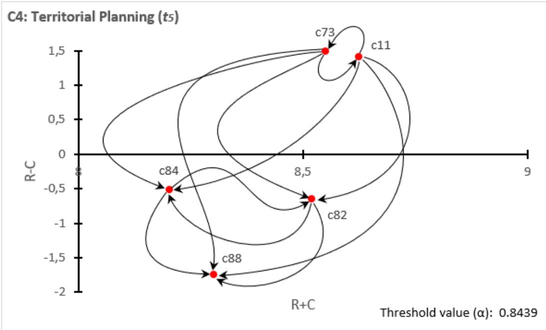
Governance-related Actions	
c34	Performance supported by an integrated, sustainable strategy and its public dissemination
c19	Streamlining of administrative processes
c8	Promotion of cost-controlled housing programs
c7	Development of renewal incentive programs
c31	Co-governance
c35	Creation of financial instruments to support renewal through condominiums
c33	Municipalities' greater capacity to control and monitor



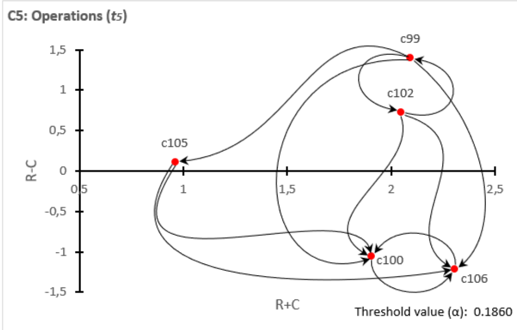
Community Involvement-related Actions	
c44	Participation in decision-making processes
c60	Initiatives and activities involving the community
c50	Creation of a sense of belonging
c43	Residents' new transformative skills
c55	Development of strategies for appropriations of public spaces
c39	Citizenship education
c47	Identification of local stakeholders



Economic Context-related Actions	
c112	Synergies with bordering areas
c114	Investment in self-employment and local economy
c111	Creation of hubs of attractiveness for trade and proximity services
c110	Revitalization of urban centers
c120	Artistic and cultural interventions



Territorial Planning-related Actions	
c11	Urban, social, and financial planning with intervention strategies
c82	Creation of green and leisure spaces
c84	Existence of equipment for groups
c73	Planning instruments
c88	Upgrading of public areas



Operations-related Actions	
c100	Promote regular maintenance of spaces and buildings
c106	Removal of degraded buildings…
c102	Regular inspections from authorities
c99	HR in local councils w/the education and availability to do hands-on work in the field
c105	Organize seminars and/or debates about blight

Figure 6. Intra-cluster Cause-and-effect Relationships at t_5

Figure 6 shows results of different types of simulations and analyses, revealing that stakeholders in general should understand variable change to engage in more structured, conscious decision-making processes involving urban blight prevention strategies. For instance, within the governance cluster (C1), co-governance (c31) and the development of renewal incentive programs (c7) need to be highlighted as the two most important prevention initiatives, given the scores obtained in the R+C axis. However, co-governance was clearly identified as a cause of rehabilitation incentive program development, which was identified as an effect in the MA-DEMATEL analysis (*i.e.*, c31 causes c7, according to the R–C axis).

In addition, within the community involvement cluster (C2), the scores obtained on the R+C axis show that the creation of a sense of belonging (c50), development of strategies for appropriations of public spaces (c55), and initiatives and activities involving the community (c60) were all considered extremely important urban blight prevention strategies. However, these three preventative initiatives were understood to be direct effects of citizenship education (c39) and the identification of local stakeholders (c47), as shown on the R–C axis. Regarding the economic context cluster (C3), the revitalization of urban centers (c110) and creation of hubs of attractiveness for trade and proximity services (c111) were not only considered the most important prevention initiatives but also the causes of the remaining strategies within this cluster.

In terms of the territorial planning cluster (C4), urban, social, and financial planning with intervention strategies (c1) and planning instruments (c73) were considered extremely important by the panel participants. This significance is due the way these factors influence each other and generate the remaining prevention strategies within this fourth cluster. Finally, regarding the operations cluster (C5), human resources in local councils with the education and availability to do hands-on work in the field (c99) and the removal of degraded buildings to prevent them from becoming the basis of further urban blight (c106) were considered the most important prevention initiatives. However, the first determinant was considered a cause, while the second was categorized as an effect.

Altogether, results from the panel's collective analyses are consistent with and support prior studies (*e.g.*, Ferreira *et al.*, 2018; Sun *et al.*, 2019), particularly regarding the identification of potential causes of urban blight and respective prevention alternatives. However, unlike previous research, the proposed methodology allows for a holistic perspective on the issue under analysis (*i.e.*, urban blight), and the inter- and intra-cluster MA-DEMATEL analyses performed can reinforce experts' understanding of variable change over time and with different degrees of urban blight. An important feature of this process is that it allows for an interactive exploration of changes in inputs to the model, such that the impact of such changes can be seen immediately. This offers opportunities for further discussion (again, a reflection of the recursive and constructivist nature of the framework).

Although this methodology is not without limitations, all blight prevention strategies included in the developed causal map can affect the evolution of urban blight. Thus, decision makers and managers need to analyze and constantly control for possible variations of urban blight and encourage proactive attitudes among all stakeholders in the fight against urban blight. Overall, the proposed methodology provides strategic support for urban blight prevention policy development, greater public awareness, changes in practice, and active cooperation with societal stakeholders. Notably, many other opportunities exist for the application of the methodological approach developed in this study. Due to its process-oriented nature, the procedures followed—when correctly adjusted—can work equally well with different panels of experts and/or in other decision contexts. Other applications include areas such as artificial intelligence, machine learning and robotics, dynamic systems analysis, psychology of decision making, intelligent user interfaces, and group decision making, where cognitive modeling is required or seasonal constrains exist.

4.3 Discussion, Consolidation, Implications, and Recommendations

To ensure that both the methodological framework and results could achieve greater reliability, a consolidation session was held with two board members of the *Direção Geral do Território* (General Directorate of the Territory of Portugal) (DGT). The DGT is the Portuguese public organization responsible for government policies regarding spatial and urban planning. The specialists interviewed were crucial to this study because they were not only seasoned professionals but also not members of the decision-maker panel, thus they played a neutral role throughout the results consolidation process. Initially involving the two DGT board members in the group sessions would have increased both their understanding and ownership of the analysis system. However, as previously explained, the objective of the consolidation session was to ensure that both the methodological framework and results achieve greater reliability. For that to be possible, the interviewees needed to be not only seasoned professionals but also not members of the decision-maker panel. Only in this way could they play a neutral role throughout the results consolidation process.

The consolidation session was divided into four phases. The first was a presentation of the topic and methodology since the term urban blight required clarification to avoid bias in the two board members' analysis. The two board members assessed the methodological processes and results achieved in the second phase. In the third phase, the advantages and limitations of the proposed methodology were examined in detail. The last phase consisted of a technical discussion regarding how this decision-making system could be implemented at the DGT.

The interviewees expressed enthusiasm about conducting research on urban blight and felt that studies regarding its causes could facilitate discussions of preventive strategies and initiatives, thereby avoiding the further creation of blighted areas and its spread. These comments clearly highlighted the practical relevance of both the current study and its proposed methodology.

Regarding the methodological procedures followed and results achieved, the interviewees stated that they are *"consistent, mainly because the analysis system developed is able to measure the qualitative components of urban blight, which are many and diverse"* (in the interviewees' words). During the second phase of the consolidation session, various blight-prevention initiatives were discussed based on the group causal map developed. In particular, the importance of the territorial planning and operations clusters was highlighted, as well as the significance of the governance and community involvement clusters, due to their high degree of centrality in the collective cognitive structure defined (see Figure 3). The incorporation of MA into the collective analysis process was considered *"ingenious"* (term used by the interviewees), because it fostered informed decision making based on variable-change analyses subject to seasonal constraints.

When the interviewees were questioned regarding advantages of the proposed framework for practice and policymaking, they described the system *"as detailed and meticulous, covering many causes of urban blight"* (in their words). This appears to be an advantage when compared to current practices because our methodology supports decision makers with a transparent, simple, well-informed decision-support system that comprises both objective and subjective components. They also mentioned that the *"model is comprehensive and it can be easily adapted to support the development of different prevention strategies against urban blight"*. This last comment highlighted the holistic perspective provided by the applied framework, and demonstrated that the expert panel had taken the time and much thought in making the decision-support system as complete as possible. Due to process-oriented nature of our framework, all methodological steps and procedures were carefully analyzed by and discussed with the two DGT board members. As pointed out by Bell and Morse (2013, p. 962), in this approach *"there is less emphasis on outputs per se and more focus on process: how the group members interact and what they learn about themselves from that interaction"*.

Regarding the model's limitations, the interviewees pointed out that the map should be streamlined. They suggested that *"a simplified map showing the most important prevention strategies and initiatives would capture the attention of politicians and/or others with crucial decision-making powers more easily"* (also in their words). This limitation reflects how little time politicians may devote to carefully analyzing all the information included in the collective causal map. Thus, a more intuitive model may foster an expedited and more relevant expert response.

In addition, the model-building process was considered context dependent, which reflects the constructivist stance assumed from the beginning of the study (see Belton and Stewart (2002), Ackermann (2012), and Assunção *et al.* (2020) for further discussion on the advantages and limitations of this approach). However, because of the clear potential of this analysis, the interviewees found that the framework and results constitute an initial step toward understanding causes of urban blight, thereby helping strengthen proactive strategies by city councils and other decision makers involved in urban development.

At the end of the consolidation session, the interviewees were enthusiastic regarding not only the proposed methodological approach to the blight issue, which *"has not yet been applied by practitioners"* (in their words), but also the holistic, complementary perspective the integrated methodology offers. Regarding the practical applicability of the approach at the DGT, the interviewees asserted that the results should not be neglected as they could be a valuable source of information. They also said that the DGT was interested in and receptive to discussing the integration of the proposed system and placing it into practice to assist experts in making decisions closer to reality in the fight against urban blight. This application would necessarily depend on decision makers' schedules and availability for clarification meetings.

Overall, the interviewees confirmed that the methodological framework developed is a robust tool that supports decision making that assists with urban blight prevention. A "ready-to-use" approach and direct extrapolation of the present findings, however, have to be discouraged as these results are context dependent. As discussed earlier, the constructivist and process-oriented nature of the methodology means that the procedures should work well with different panels of experts or in other contexts (*cf.* Bell & Morse, 2013; Ormerod, 2013, 2020). The proposed approach allows for added realism and displays unique, significant added value with regard to current practices as the use of cognitive mapping offers new insights based on expert knowledge. In addition, the incorporation of MA into group DEMATEL facilitates the development and application of a new algorithm (*i.e.*, MA-DEMATEL), fostering more informed and conscious decision making based on variable-change analysis subject to seasonal constraints.

5. CONCLUSION

Urban blight is an on-going problem in contemporary urban societies that requires increasingly careful attention. Because of degraded areas, cities and neighborhoods fail to attract needed businesses, which negatively affects blighted neighborhood sources of income and creates social problems and safety issues for urban populations.

Our results and discussion support the conclusion that cognitive mapping, MA and DEMATEL can be combined to develop prevention strategies for detection and eradication of urban blight. Theoretical results include, first, the discussion and clarification of urban blight by field experts and practitioners. Second, the adopted methodological approach facilitates added realism and displays unique and significant added value in terms of current blight detection and eradication practices as the combined use of cognitive mapping, MA and DEMATEL contributed to new insights based on expert knowledge. As noted by Belton and Stewart (2002) and Marttunen *et al.* (2017), mixed methods stimulate new causal thinking, and some of the insights obtained would not have been detected using statistical methods alone. Third, many prevention strategies and initiatives addressing urban blight were identified, along with their cause-and-effect relationships, thereby answering the two research questions initially presented: *"What are the most significant dimensions, determinants, and/or decision criteria to consider in analyses of urban blight prevention strategies?"*; and *"How can the dynamics of the cause-and-effect relationships between these multidimensions and/or decision criteria be analyzed when urban blight is subject to seasonal constraints defined by population flows?"*. Fourth, the use of cognitive mapping allowed for a more holistic perspective on urban blight prevention strategies. Last, the inter- and intra-cluster MA-DEMATEL analyses performed strengthened the panel members' understanding of variable changes over time.

Overall, our study combines cognitive mapping and MA-DEMATEL, allowing different expert opinions to be aggregated, and creating a holistic framework shared by all. This facilitated discussion, detection and understanding of cause-and-effect relationships among decision criteria. Our study resulted in our designing a transparent, realistic and well-informed system that comprises both objective and subjective components. Although subjective in nature, our methodology promotes the exchange of ideas and experiences, boost a deeper understanding of decision situations and uncover the cause-and-effect relationships among criteria. This, in turn, supports decision making in a structured and practical manner. As for precision, timely adjustments to specific decision criteria and/or to their causal relationships are possible because our approach allows for the addition of new information over time, which in turn provides decision makers with possibly needed adjustment possibilities. Notably, other decision makers may wish to apply our methodology to their own city or specific jurisdiction. Even though they may not understand the "process", they may like to know our final recommendation(s). Thus, we recommend that other decision makers study both at the causal map (see Figure 3) and DEMATEL diagrams (see Figure 6), and select the blight prevention strategy(s) that best fit their unique situation. We could have prioritized items that may have the greatest impact; however, this would require a casuistic basis due to specific characteristics of each area/location.

Our methodology makes important contributions. First, by combining and integrating MA and DEMATEL (*i.e.*, MA-DEMATEL)—a new algorithm in operational research (OR)—we more effectively and holistically offer solutions for the identification and eradication of urban blight. Second, the description of the procedures for this unique OR approach contributes to the existing knowledge by allowing replications for other applications, contexts or with different groups of experts due to the process-oriented nature of the proposed methodology. This approach may impact practitioners as both the methodology and results were thoroughly discussed with and among the panel of experts, and consolidated by two DGT board members, who supported an application of the proposed methodology to practice. The proposed approach also includes a strategy to support policy development, greater public awareness, changes in practices, and active cooperation with societal stakeholders.

Five problems arose during the study. The first was the challenge of finding field experts who had had previous contact and familiarity with urban blight. The second difficulty was obtaining commitment from these experts to spend many hours in repeated group meetings over a period of 2 years developing the proposed decision-support system. The third challenge was divergences in opinion among panel members, which sometimes made the group meetings cognitively demanding and extremely time consuming. Last, in addition to finding experts, was identifying experienced professionals with sufficiently specific knowledge to serve on the consolidation team.

Qualitative and quantitative aspects of urban blight were identified in a transparent way during the model-building process and analyses, thereby facilitating the formulation of proactive anti-blight strategies. While results are context dependent, contextualized model findings may compensate for weaknesses of standard models in terms of responding to realities and externalities that vary from country to country. Thus, the applied framework may be effectively applied to different urban environments, helping diverse stakeholders to avoid urban neighborhood deterioration and contributing to an improved balance between the sustainability of the real estate market and the needs of society at large.

Given the limitations presented, additional research is required, first, to conduct similar studies with other expert panels in order to assess how close to reality the proposed approach is. Second, replica studies should be carried out in other geographical contexts to ascertain possible differences in results. Last, further research using complementary methodological approaches are important to extend the understanding of urban blight socio-technical causes and eradication. This and future studies may provide city planners, city councils, public executive and private investors with sufficient knowledge to inaugurate urban blight solutions. Additional contributions that advance the work reported in this study will always be welcome.

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