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IDENTIFICATION OF BUILDING REPAIR POLICY CHOICE CRITERIA ROLE

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Abstract. Preparation of building repair activities in multi-family dwelling houses poses an important problem for habitat co-operatives in Poland. Firstly, such co-operatives own and manage a lot of buildings. Secondly, scarcity of economic and non-economic resources requires their effective allocation. Such allocation should be based on properly prioritised actions' alternatives. Unfortunately, due to the complex influence of the surrounding environment, the influence of a considerable number of components and diverse point of views is to be included during the analysis of repair needs. Potential influences result from a bunch of sources. The sources are of economic, technological, social and environmental nature. To support a decision-maker effectively, information pertaining to the importance of particular influences is required. Such information can be obtained by special means of multi-criteria decision analysis (MCDA) methodology. The application of the chosen approach – DEcision MAking Trial and Evaluation Laboratory (DEMATEL) for classification of repair needs assessment criteria to shape repair policy appropriately is presented in this paper.

Keywords: civil engineering, habitat co-operative, dwelling house, repair, needs, classification, multi-stakeholders, multi-criteria evaluation, DEMATEL, sensitivity analysis.

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1. Introduction

Maintenance of building resources in habitat quarters is a complex task. Ownership structure of multi-family dwelling houses in Polish cities is very different. However, a lot of the houses belong to housing co-operatives. Social ownership makes management even harder.

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This is mainly due to conflicting interests of individuals and groups of individuals in such co-operatives. The scale of problems depends on co-operative size.

Buildings repair policy comprises one of the most important activities of a co-operative. Because of technical nature of buildings, repair needs are identified during technical state inspections. Summarised inspection outcomes define needed interventions. Additionally, the importance and urgency of the interventions are identified. Revealed needs comprise a base for repair activities planning. Frequently, a number of buildings requires repair at a moment. Due to limitation of financial and other resources, identification of appropriate sequence of repair activities and resource allocation is necessary.

The decisions made are usually based on an economical criterion only, and the influence of other issues is taken into account only intuitively. In reality, the conflicting nature of issues pertaining to interests of diverse stakeholders makes decision-making even harder. Additionally, some of the issues can be of intangible nature. Therefore, identification of appropriate repair activities' sequence requires application of a special methodology. Such methodology should be able to include different points of view pertaining to involved stakeholders, e.g. inhabitants, co-operative management and maintenance services.

To identify sequence of activities reliably, the influence of a number of appropriate criteria should be included. For example, complex repair interventions should be preferred. Although, available resources limitation can force a maintainer to prefer more time consuming approach. Organisational aspects ought to be included as well, and so on. Undoubtedly, included criteria differ by a level of importance. To make the identification robust only the most important criteria could be applied for the sequence identification. Therefore, it is crucial to know the role of criteria governing choice of repair policy exactly. And it is important to include the opinions of involved stakeholders.

Decision-making problems in civil engineering are complex and their solution depend on multiple criteria. The problem considered is not different. Therefore, a multi-criteria decision analysis approach (MCDA) can be applied for obtaining the problem's solution. Although researchers have shown interest in application of the approach, the applications are not so common. There are, however, some exceptions, e.g. a book by Opricovic (1998).

The problem of the key criteria identification appears in publications which deal with practical applications for building repair policy assessment, e.g. the papers by Zavadskas and Vilutienė (2004, 2006). One should not also forget the context of application. Robust building repair policy assessment requires identification of the criteria best suited for the local conditions. Therefore, practical publications devoted to assessment of the policy consider sets of the criteria well suited to actual needs only.

A need for priority assessment with regard to appropriate attributes results in search for more robust assessment approaches. Works dealing with such problem are scarce, e.g. Shen and Lo (1999) address the criteria priority assessment problem in the case of local Hong Kong conditions and include a survey of other interesting (although more limited) approaches. Additionally, the application of multi-criteria decision analysis (MCDA) approach and the possibility of including intangible aspects make the proposition of Shen and Lo even more interesting. However, there are more MCDA methods available (Figueira *et al.* 2005). Thus, it seems that a need for robust identification of the most relevant criteria with regard to repair policy assessment should profit more from the development of MCDA methodology.

Shen and Lo applied Analytic Hierarchy Process (Saaty 1980) to prioritise the criteria. A relatively less popular method, namely DEcision-MAking Trial and Evaluation Laboratory (DEMATEL) (Fontela and Gabus 1974), is applied in the paper for the classification of the criteria. Its extension using the zero unitarisation method (ZUM) (Ginda 2008) allows to combine the influence of different points of view (called for short just merits) seamlessly.

The following set of attributes (criteria) being decisive for repair policy choice is assumed:

1. expected economical effects of interventions (EE),
2. safety for users and a building (SA),
3. required amount of financial resources (RF),
4. available amount of financial resources (AF),
5. securing against building degradation (DS),
6. needs for modernisation (MN),
7. a need for missing elements' completion (MC),
8. expected improvement in energy conservation (EC),
9. effects of previous interventions (PI),
10. improvement of aestheticism (AE);
11. perceived organisational issues (OI);
12. demands of inhabitants (ID);
13. a social justice concept (SJ).

The above set is based on the opinions of both management staff and members (inhabitants) of a typical medium-size Polish habitat co-operative.

The merits of two different kinds are included. The first one corresponds to an economical point of view and the second – to a social point of view. The merits represent opinions of two most important stakeholders – co-operative management and inhabitants.

2. Utilised approach

The DEMATEL was originally developed at Batelle Geneva Institute to cope with complex local and worldwide problems effectively. Its main application pertains to the identification of relations between causes and effects of considered problems, e.g. work by Chiu *et al.* (Chiu *et al.* 2006). Development of the method resulted in several improvements – see works by Tamura and Katsuhiro (2005), Hung *et al.* (2006). It proved also reliable with regard to clustering and prioritising of decision-making problem attributes (Dytczak and Ginda 2008).

The method is based on a concept of pair-wise comparison of decision-making attributes (problem solution alternatives, criteria etc.). The attributes are compared with regard to relative influence. Discrete assessment scale 0-M is applied. Assessment equal to zero pertains to a lack of influence and assessment equal to M denotes the extreme influence of the first compared attribute on the other one. Intermediate scale levels express intermediate states of influence. Structure of comparisons is described using a graph of direct influence and its numerical representation, i.e. direct influence matrix *A*. The number of rows and columns of the matrix is equal to the number of compared attributes (n). The i-th row of *A* is devoted to the influence of the i-th attribute on all attributes including itself. The influence can express relative importance of attributes too. Evaluations of the influence contained in the j-th column are related to comparison outcome with regard to the *j*-th attribute.

Matrix *A* is normalised then, using the highest value of row-wise sum of its components. Thus, normalised direct influence matrix (*N*) can be obtained (1).

$$N = \frac{A}{\max\limits_i \sum\limits_{j=1}^{n} a_{ij}}, \tag{1}$$

where the max operator denotes the biggest value of row-wise sum of matrix *A* components.

N makes it possible to define matrix of complete (direct and indirect) influence of considered attributes (*T*), using formula (2):

$$T = N \cdot \left(I - N\right)^{-1}, \tag{2}$$

where *I* denotes the identity matrix $n \times n$.

Indirect influence of considered attributes is expressed by the matrix of indirect influence T_i described by the formula:

$$T_i = N^2 \cdot \left(I - N\right)^{-1} . \tag{3}$$

Finally, special indices are obtained for each attribute. Value of the first one – s^+ (the position) expresses overall activity of an attribute, while the second one – s^- (the relation) – relative (compared with other attributes) strength of an attribute. The indices are computed using row-wise (r_i) and column-wise (c_i) sums of matrix *T* (4–7):

$$r_i = \sum_{j=1}^{n} t_{ij} , \tag{4}$$

$$c_i = \sum_{i=1}^{n} t_{ji} , \tag{5}$$

$$s_i^+ = r_i + c_i , \tag{6}$$

$$s_i^- = r_i - c_i . \tag{7}$$

Different dimensions (merits) of considered problem can be included by 2 extensions:

1) normalisation of indices s^+, s^- spaces, using zero unitarisation method – ZUM (Ginda 2008) (8–9):

$$\overline{s}_{ij}^+ = \frac{s_{i\,j}^+ - \min\limits_i s_{i\,j}^+}{\max\limits_i s_{i\,j}^+ - \min\limits_i s_{i\,j}^+}, \tag{8}$$

$$\bar{s}_{ij}^{-} = \frac{s_{ij}^{-} - \min_i s_{ij}^{-}}{\max_i s_{ij}^{-} - \min_i s_{ij}^{-}} \quad , \tag{9}$$

where: $\bar{s}_{ij}^{+}$, $\bar{s}_{ij}^{-}$ denote normalised values of the position and the relation indices for the i-th attribute respectively – min and max operators describe extreme values of the indices obtained for the j-th problem merit;

2) appropriate multi-merit aggregation of the indices' values (e.g. Dytczak 2008):

$$\bar{S}_i^{+} = \sum_{j=1}^{k} w_j \cdot \bar{s}_{ij}^{+}, \tag{10}$$

$$\bar{S}_i^{-} = \sum_{j=1}^{k} w_j \cdot \bar{s}_{kj}^{-}, \tag{11}$$

$$\sum_{j=1}^{k} w_j = 1, \tag{12}$$

where: k denotes the number of considered problem merits, w_j – normalised numerical expression of the j-th merit's importance, and $\bar{S}_i^{+}$, $\bar{S}_i^{-}$ denote aggregated values of indices for the i-th attribute.

Multi-merit aggregation comprises the basis for a kind of sensitivity analysis. The analysis deals with influence of decision maker's preferences with regard to relative importance of included merits. The sensitivity analysis results can be also utilised for the identification of overall attributes' performance.

Finally, a kind of aggregated classification is delivered. The classification corresponds to the whole set of all considered attributes and problem merits. It is obtained utilising a kind of sensitivity analysis with regard to the results obtained separately for diverse points of view.

3. Numerical analysis

The analysis deals with the previously defined list of n = 13 attributes. Their role with regard to intervention policy planning is assessed considering k = 2 problem components: economical merits analysis and social merits analysis. However, the presented approach is capable of addressing more kinds of merits if only required. The following scale is utilised while assessing direct attribute influence (M = 3):

0 – no influence,

1 – little influence,

2 – big influence,

3 – extreme influence of the first considered attribute.

The calculations are conducted thanks to the utilisation of dedicated software. A typical spreadsheet application is applied.

To gather criteria importance assessments, typical opinions of 2 experts are utilised. The first expert is a co-operative management representative while the second one represents inhabitants.

3.1. Economical merits influence

Pair-wise inter-attribute comparisons with regard to economical merits make it possible to obtain a matrix of direct influence $A = A_e$ (Fig. 1). Each row of the matrix is dedicated to a unique attribute in the order presented in case of attributes' introduction. For example, the second row corresponds to evaluation made with regard to the safety attribute (SA). Its content justifies the following levels of the attribute's influence (Fig. 1):

- little influence on economical effects of interventions (EE) – assessment 1,
- a lack of influence on itself – assessment 0,
- big influence on a level of required financial resources (RF), available financial resources (AF) and securing against building degradation (SD) attributes – assessment 2,
- little influence on needs for modernisation attribute (MN) – assessment 1,
- big influence on missing elements completion attribute (MC) – assessment 2,
- little influence on energy conservation attribute (EC) – assessment 1,
- extreme influence on attributes pertaining to effects of previous interventions (PI), aesthetics (AE), organisational issues (OI), inhabitants demands (ID) and social justice (SJ) – assessment 3.

The resulting graph of direct influence on economical merits (G_e) is complex. Therefore, it is divided into two graph components ($G_e = G_{em} \cup G_{el}$). The first component (G_{em}) corresponds to the most influential attributes (the most contributing ones with regard to inter-attribute relation evaluation): safety for inhabitants and a building (SA), securing against building degradation (SD) and energy conservation (EC). Contribution of the above attributes to evaluation exceeds a level of 50%. And the second component (G_{el}) corresponds to the

$$A_e = \begin{bmatrix} 0 & 0 & 1 & 2 & 0 & 0 & 0 & 0 & 0 & 3 & 1 & 1 & 2 \\ 1 & 0 & 2 & 2 & 2 & 1 & 2 & 1 & 3 & 3 & 3 & 3 & 3 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 2 & 1 \\ 2 & 0 & 2 & 1 & 0 & 1 & 1 & 0 & 1 & 2 & 2 & 3 & 3 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ 2 & 0 & 3 & 2 & 2 & 1 & 1 & 0 & 2 & 2 & 3 & 2 & 3 \\ 1 & 0 & 1 & 2 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Fig. 1. Matrix of direct influence for economical merits analysis

remaining attributes. Both graphs are expanded over the same set of vertices (representing considered attributes) and they differ in non-zero arcs weights. In case of G_{em}, the arcs leave vertices of the 3 most influential attributes. The graph components are presented in Figs 2 and 3 respectively. A zero direct influence relation evaluation results in a lack of a corresponding arc. Applied thickness of arcs expresses non-zero level of direct influence (thin arcs denotes 1, medium arcs – 2 and a thick arcs – 3).

The results obtained for economical merits analysis are presented in Fig. 4 (raw values of indices) and in Fig. 5 (values in normalised space of indices).

Several clusters of attributes are identified. The first cluster contains 3 attributes of the highest values of the relation index: safety for users and building (SA), energy conservation (EC) and securing against building degradation (SD). High values of the index confirm key nature of the above attributes. The importance of the third attribute is rather average. High values of the above index for the attributes are accompanied by high values of the position index as well. These high values express vital role of all 3 attributes with regard to the process of direct influence evaluation.

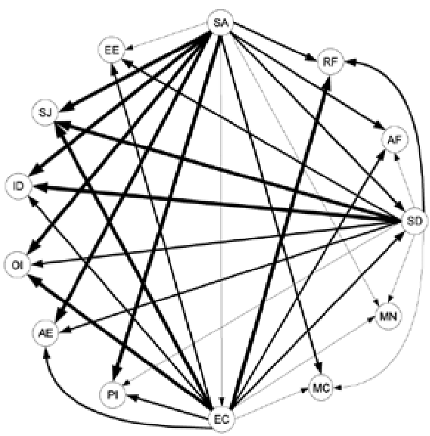

Fig. 2. Direct influence graph component G_{em}

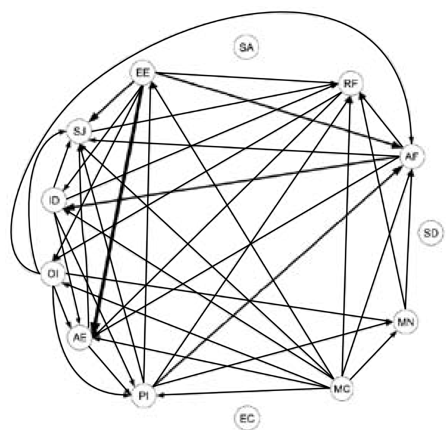

Fig. 3. Direct influence graph component G_{el}

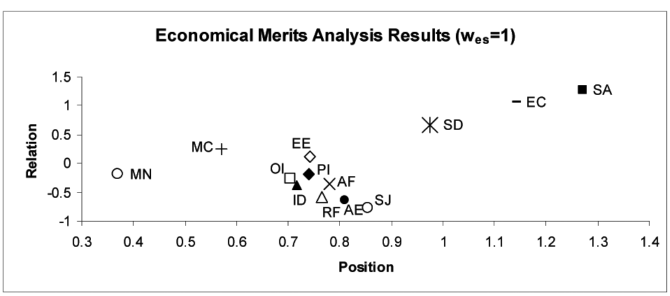

Fig. 4. Classification of attributes for economical merits

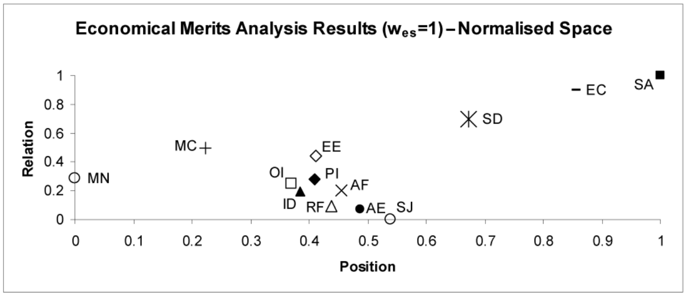

Fig. 5. Classification of attributes for economical merits (normalised space of indices)

The second cluster contains 2 attributes, namely: missing elements completion (MC) and needs for modernisation (MN). Value of the relation index in the case of the MC makes it possible to classify it as an attribute of medium importance. The importance of the second one is rather below average. Low values of the position index for both attributes express a low level of their engagement in the includes evaluation.

The third cluster group includes remaining 8 attributes. They play an average role during the evaluation due to a medium level value of the position index. However, only the attribute of economical intervention effect (EE) is of medium level importance due to the average value of the relation index. Values of this index for the rest of attributes are so low that they are perceived to be noticeably less important.

Therefore, a conclusion can be drawn that while considering economical merits only attributes related to safety and energy conservation (SA, EC, SD) are of key importance. However, there are 2 more attributes of medium importance (missing elements completion – MA and expected economical intervention effects – EE) which should not be rejected in case of economical merits analysis. All other attributes are of much lower importance.

Fig. 6 includes classification corresponding to direct influence only (obtained using matrix N). It is very similar to overall classification results presented in Fig. 7. Thus, it can

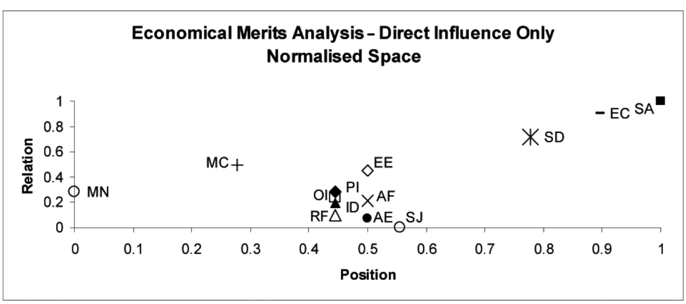

Fig. 6. Classification of attributes for economical merits obtained for direct influence only (normalised space of indices)

be stated that the overall structure of attributes classification comes mainly out from direct influence relations because indirect influences do not contribute much to final results.

3.2. Social merits influence

Social merits analysis is obtained using adequate assessments. A resulting matrix of direct influence A_s is presented in Fig. 7. And direct influence graph components ($G_s = G_{sm} \cup G_{sl}$) are included in Figs 8, 9. Again, the first graph component G_{sm} corresponds to the same attributes (SA, EC, SD), because they contribute most in evaluations. However, their contribution is a little bit smaller than in case of economical merits.

$$A_s = \begin{bmatrix} 0 & 0 & 2 & 2 & 0 & 0 & 0 & 0 & 0 & 3 & 1 & 0 & 0 \\ 2 & 0 & 3 & 3 & 1 & 2 & 1 & 0 & 3 & 3 & 3 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 3 & 0 & 3 & 2 & 0 & 2 & 1 & 0 & 2 & 2 & 2 & 1 & 1 \\ 1 & 0 & 2 & 2 & 0 & 0 & 0 & 0 & 1 & 0 & 2 & 0 & 0 \\ 1 & 0 & 2 & 2 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 3 & 0 & 3 & 3 & 1 & 1 & 2 & 0 & 3 & 1 & 3 & 2 & 1 \\ 1 & 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 0 & 0 & 1 & 0 & 2 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 2 & 0 & 0 & 0 & 0 \\ 2 & 0 & 2 & 3 & 0 & 2 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 3 & 2 & 0 & 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \end{bmatrix}$$

Fig. 7. Matrix of direct influence for social merits analysis

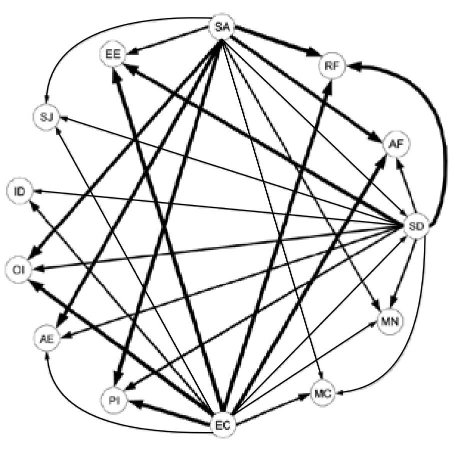

Fig. 8. Direct influence graph component G_{sm}

The results of social merits analysis make it possible to identify more attributes' clusters than in case of economical merits analysis (Fig. 10). The first, key cluster consists of the same attributes. This time, however, values of the relation index indicate a slight advantage of energy consumption attribute (EC) over safety attribute (SA) and noticeable improvement for securing against building degradation attribute (SD).

A group of medium importance attributes contains not only (as before) missing elements completion (MC) and economical interventions effects (EE), but also attributes of inhabitants demands (ID), social justice (SJ), needs for modernisation (MN) and aesthetics (AE). Average values of the relation index confirm medium importance of the attributes; and small values of the position index indicate a less important role of the attributes in the evaluation process.

The third cluster includes 3 attributes characterized by the average position: medium important attribute of economical intervention effects (EE) and less important attributes of organizational issues (OI) and the effects of previous interventions (PI).

The last cluster includes 2 attributes (available financial resources – AF and required financial resources – RF) of marginal importance and high level engagement in evaluations. And once again, overall results come mainly from the direct influences of attributes (Fig. 11).

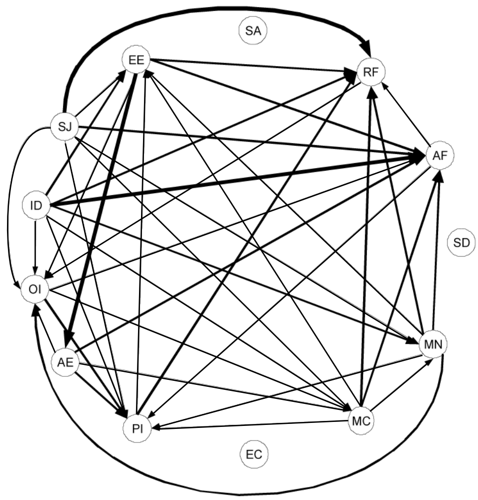

Fig. 9. Direct influence graph component G_{sl}

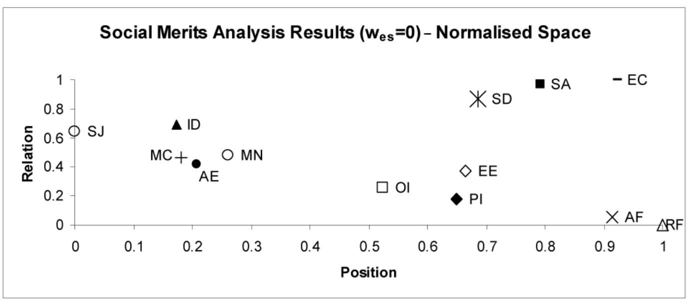

Fig. 10. Classification of attributes for social merits analysis

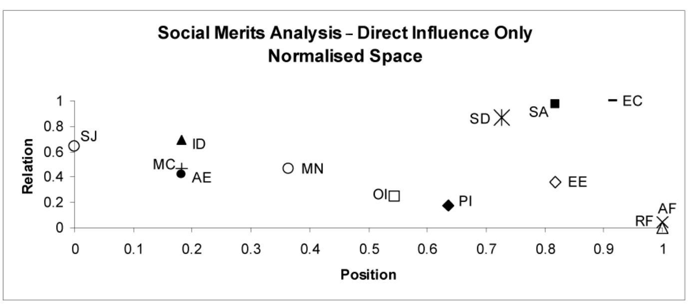

Fig. 11. Results for social merits analysis (direct influence only)

3.3. Sensitivity analysis of criteria importance

Finally, a kind of sensitivity analysis is applied for identifying a recommended subset of decision attributes worth including during building repair policy choice. The analysis pertains to a mix of 2 idealised problem views. The views are devoted to considered merits. The analysis takes into account linear changes in values of both utilised classification indices between the views. Because only 2 kinds of merits are included, definition of only one weight (w_{es}) is sufficient to express aggregated values of the indices for each attribute (13):

$$\begin{cases} S_i^+ = w_{es} \cdot \overline{S}_{ie}^+ + (1 - w_{es}) \cdot \overline{S}_{is}^+, \\ S_i^- = w_{es} \cdot \overline{S}_{ie}^- + (1 - w_{es}) \cdot \overline{S}_{is}^-, \end{cases} \tag{13}$$

where: S_i^+, S_i^- denote overall values of respective indices for the i-th attribute; value of weight w_{es} expresses relative importance of the economical merits relative to the social merits; $\overline{S}_{ie}^+$, $\overline{S}_{is}^+$, $\overline{S}_{ie}^-$, $\overline{S}_{is}^-$ denote aggregated values of indices (10–11) obtained for economical (subscript *e*) and social (subscript *s*) merits.

The value of weight w_{es} equal to zero corresponds to the case of exclusive dependence on social merits (Fig. 10) and w_{es} equal to one – to exclusive dependence on economical merits (Fig. 5). Intermediate values of w_{es} express the level of preference with regard to the economical merits case relative to the social merits case. The results obtained assuming 4 intermediate levels of preference level are presented in Fig. 12. Of course, Figs 10 and 5 respectively complete the whole set of results obtained for considered levels of preference: 0, 0.2, 0.4, 0.6, 0.8 and 1. Presented results reveal noticeable sensitivity of outcomes obtained for attributes to changes in the preference level.

To illustrate sensitivity issues, additional figures are included. They present changes in aggregated value of the relation index due to preference level changes. These figures generally pertain to different sets of attributes. Fig. 13 deals with candidates for a group of the most important attributes, Fig. 14 – candidates for a group of medium-importance attributes and Fig. 15 – candidates for a group of small importance attributes.

To draw the final conclusions with regard to the role of the considered attributes, a dedicated measure of their importance is applied. The measure is based on a concept of a field F_i (14) located below a line which describes changes in a value of the relation index for the i-th attribute on a graph dedicated to the attribute. The measure takes values from a closed interval [0,1]. The larger value of the measure, the higher preference for the considered attribute.

$$F_i = \int_0^1 S_i^-\left(w_{es}\right) \mathrm{d}w_{es} = \frac{S_{ie}^- + S_{is}^-}{2} \quad . \tag{14}$$

Of course, in case of $k > 2$, formula (14) should be replaced by the appropriate multidimensional integral. The actual number of integral dimensions corresponds to the number of considered merits k. The higher number of dimensions undoubtedly leads to more complex calculations of integral value. The application of simulation-based Monte Carlo method can ease calculations a lot then.

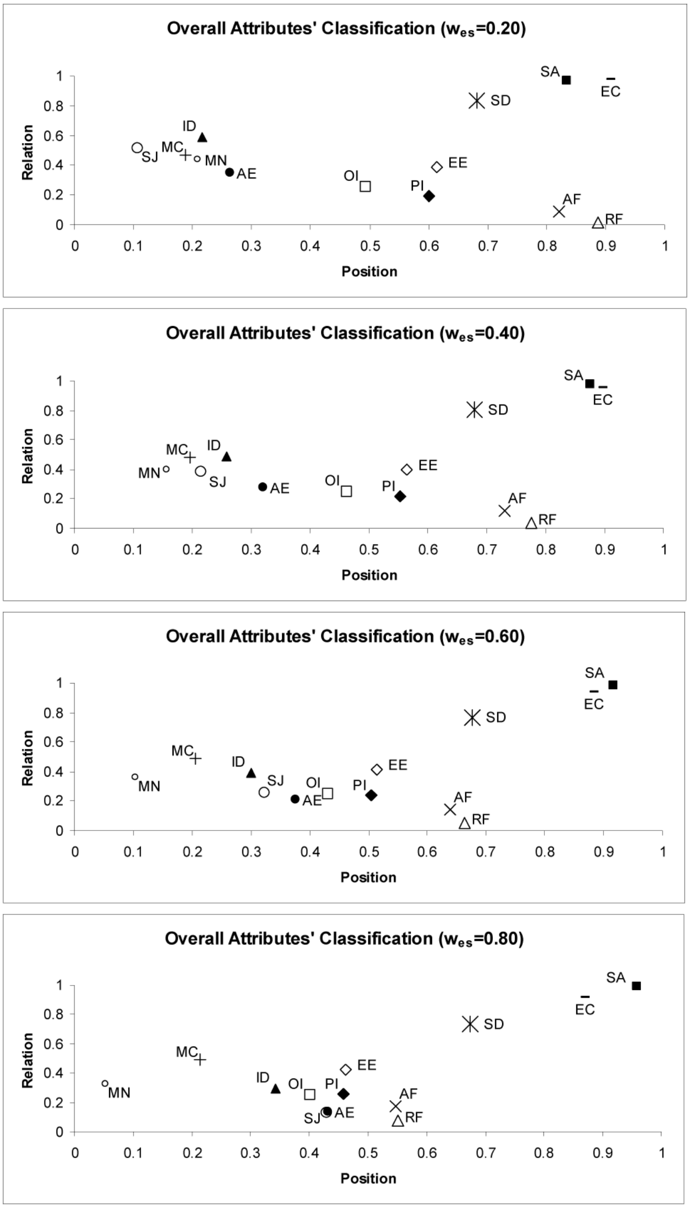

Fig. 12. Aggregated results for different levels of w_{es} (normalised space of indices)

Obtained values of F_i make it possible to assign each attribute to one of the 3 distinct classes, defined using arbitrary assumed limits:

1). the key attributes ($0.70 \le F_i \le 1$),

2). the medium importance attributes: ($0.30 \le F_i < 0.70$),

3). the small importance attributes: ($0 \le F_i < 0.30$).

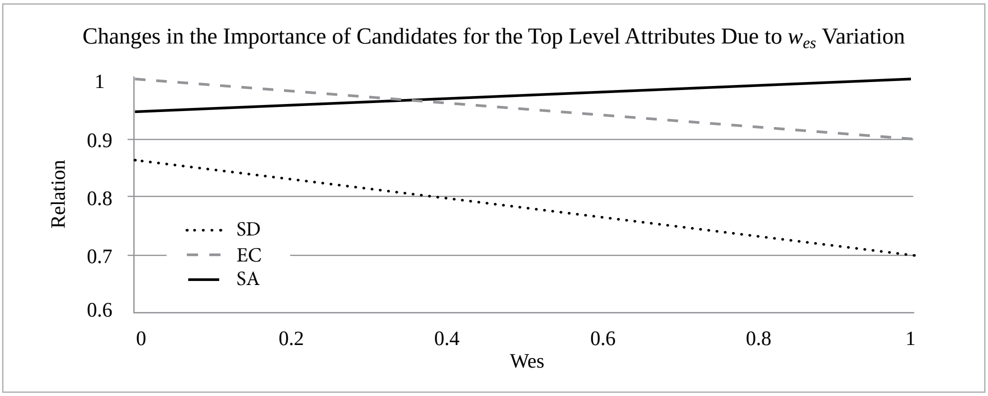

Fig. 13. Function $S_i^-(w_{es})$ for candidates for top level attributes

The final results are presented in Table. Unsurprisingly, the key role of attributes playing important role in both considered cases of problem merits is fully confirmed by calculations of F_i. These attributes should be taken into account during a policy choice.

The final group of the medium importance attributes includes: missing elements completion (MC), demands of inhabitants (ID), expected economical intervention effects (EE), needs for modernisation (MN) and social justice (SJ). These attributes can be included during the repair policy choice. However, they should rather play a supplementary role. Other attributes proved less important and thus can be safely rejected.

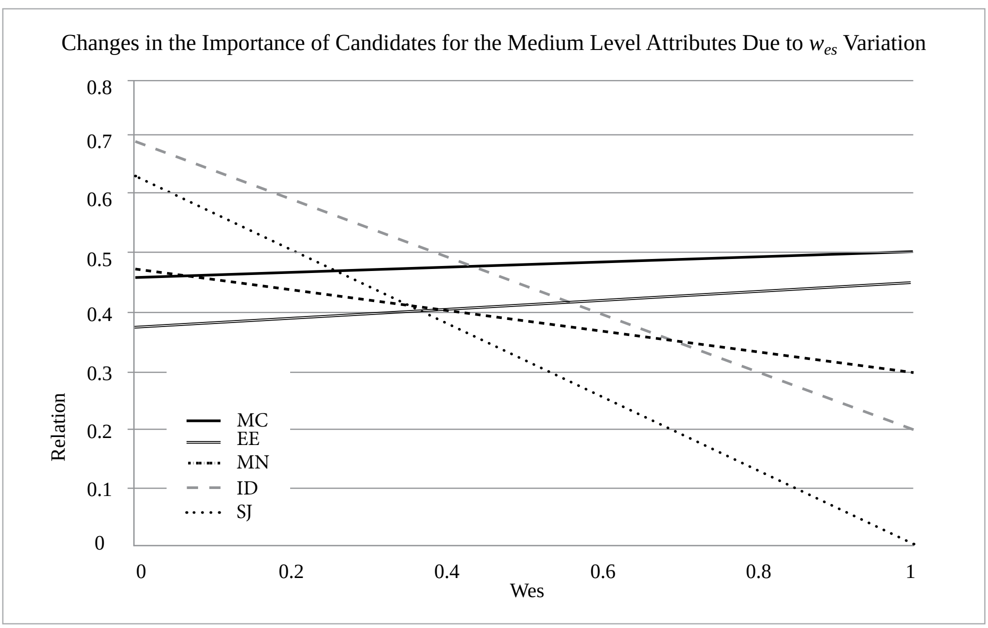

Fig. 14. Function $S_i^-(w_{es})$ for candidates for medium-level importance attributes

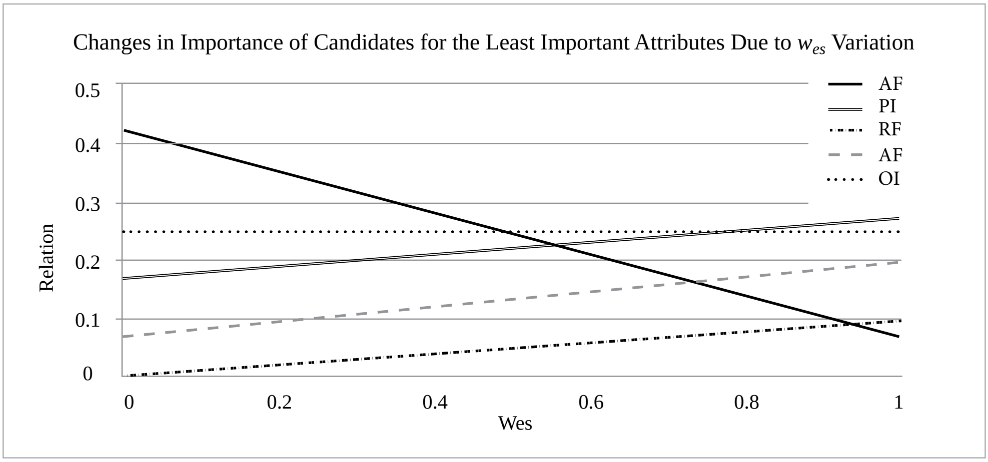

Fig. 15. Function $S_i^-(w_{es})$ for candidates for low level importance attributes

Table. Final classification of considered attributes

Attribute	F_i	Importance
SA	0.9827	Key
EC	0.9480	Key
SD	0.7847	Key
MC	0.4829	Medium
ID	0.4421	Medium
EE	0.4051	Medium
MN	0.3811	Medium
SJ	0.3201	Medium
OI	0.2505	Small
AE	0.2436	Small
PI	0.2290	Small
AF	0.1316	Small
RF	0.0451	Small

4. Conclusions

The example presented reveals strengths of DEMATEL-ZUM combination application for decision-making support with regard to repair policy preparation. The proposed approach allows to identify the role of criteria governing assessment of policy alternatives to make more justified, multi-criteria policy choices.

Of course, the considered list of criteria is of sample nature. However, the criteria included represent very different (both tangible and intangible) issues, which should be undoubtedly taken into account. To obtain more valuable results, application of thorough criteria selection procedure is required. It would be also advantageous to extend the approach. For example, the support for group decision-making can be added. It should be an easy task because DEMATEL supports group making support as well.

However, it seems that even the presented, limited form of the approach comprises vital alternative and completion to other MCDA approaches (Dytczak 2008).

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PASTATŲ REMONTO STRATEGIJOS PARINKIMAS

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Santrauka

Pasirengimas remontuoti daugiabučius gyvenamuosius namus sukelia daug problemų tokių namų kooperatyvams Lenkijoje. Pirma, tokie kooperatyvai turi ir valdo daug pastatų. Antra, dėl nepakankamų ekonominių ir neekonominių išteklių reikia juos efektyviai paskirstyti. Toks paskirstymas turi būti pagrįstas išnagrinėjus alternatyvas ir nustačius prioritetines. Deja, remonto poreikio analizę veikia sudėtinga aplinka. Tam įtaką daro daug komponentų, reikia suderinti įvairius požiūrius. Potenciali įtaka kyla iš šaltinių gausos. Yra ekonominiai, technologiniai, socialiniai ir gamtinės aplinkos šaltiniai. Efektyviam sprendimui priimti reikia turėti informacijos apie įtakos svarbą. Tokiai informacijai gauti gali būti pritaikyta speciali daugiakriterinės sprendimų analizės metodologija. Straipsnyje pristatomas metodas, kuriuo vertinami remonto poreikio kriterijai ir padedama suformuluoti remonto politiką.

Reikšminiai žodžiai: statybos inžinerija, gyvenamųjų namų kooperatyvas, daugiabutis namas, remontas, poreikiai, klasifikacija, dalyviai, daugiakriterinis vertinimas, jautrumo analizė.

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