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VERBAL ANALYSIS OF RENOVATION INVESTMENT STRATEGY OF OLD TOWN

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ABSTRACT

In project development it is hardly possible to get exhaustive and accurate information. As a result, the situations occur, the consequences of which can be very damaging to the project. Inaccurate evaluation of the strategy related to capital investment and project implementation is one of the reasons why such estimates are not required in practice. Instead, a classification approach may be used for this purpose. Classification is a very important aspect of decision making. This means the prescription of objects to particular classes. Classified objects are described by various criteria that can be quantitatively or qualitatively evaluated. In multi-attribute environment it is hardly possible to achieve this without resorting to special techniques. A new way to solve the problem – the CLARA method (Classification of Real Alternatives) is offered. The paper presents a feasibility study of using verbal classification for determining a better strategy, depending on the evaluated strategy level. This article presents a new way to solve the problem - the CLARA expert verbal method. Formally, the problem is stated as one of multicriteria classifications. A hierarchical approach to the considered effectiveness indicators is proposed. The proof of the method effectiveness is presented. The process of method's practical application is described.

KEYWORDS

Strategy, investment, efficiency, assessment, multi-attribute decision making, classification.

1. INTRODUCTION

Investigation and discussion of problems associated with the old town renovation have intensified since the 1990 s. The heated debates on sustainable urban development in the world are going on now, and a compact city appears to be one of the best options for sustainable development [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]. G. Munda [in 12] states that sustainable development is a multidimensional concept, including various perspectives. He showed that multi-attribute decision analysis is an adequate

approach to deal with sustainability conflicts at both micro and macro levels of analysis.

The assessment and measurement of economic values provided by Cultural Built Heritage has been increasingly recognised as a fundamental part of cultural policy [13, 14]. Cultural heritage has economic importance because the state of conservation management and access conditions influence human well being [15, 16, 17, 18, 19]. The argument in support of a multi-dimensional framework, is reinforced by Ver Eecke [20, 21]. Economic value does not deny the importance of other value dimensions, but has a specific role to play in cultural policy toward heritage fruition, enhancement and conservation [22].

Old Town is rich in historic resources and is second in the number of historic districts and well designed historic buildings. There is a great number of interested parties involved in the old town conservation, development and renewal. They embrace old town residents, offices, companies, travel agencies as well as historians, architects, urban developers, etc. Old town includes various neighbourhoods, individual houses and their groups. In addition, it has a complicated system of engineering structures and service lines often going through the remaining foundations of old buildings and communication lines. All of them have been formed under various conditions at various periods of time.

Despite the intention of many heritage organizations to identify models that can be used for managing decision-making in urban conservation areas, there is as yet no information model that is capable of integrating different levels of analysis of data structures and their relevant characteristics. The lack of such a model has exacerbated the difficulties and conflict in the selection and assessment of alternative intervention strategies in urban conservation areas [23, 24].

The diverse range of heritage categories, values and types of data related to the conservation of monuments, buildings, and their surroundings provides a challenge in developing an adequate information model for informing the management of interventions.

Heritage can be conserved for its cultural value if it is a product of human manufacture, material and nonmaterial artistic expression or a form of social organization and ideology that characterizes the life of a community. The attributes of these variables must have symbolic, shared, learned, adaptive, transmitted cross-generational aspects. Such cultural variables when reviewed in relation to innovation, cultural loss, acculturation, applied anthropology syncretism, revolutionary movement can help in identifying the cultural values of heritage.

Heritage is conserved for its educational value if it contributes to the development of sciences, including archaeology, architecture, engineering, anthropology etc..

To assess the socio-economic value of heritage a number of variables need to be studied. Such variables include the quality of the resource, its function, its use, optional and non-use value, its obsolescence and its conservation cost. These variables involve also quality requirements by customers, quality of visitors, quality of competitors and the quality of services Price of goods, scarcities, purchasing power, desires, utility and the travel costs; all these variables need to be studied in relation to the economic and social regeneration, investment and saving resources as well as funding attractions. Usually such values are to be measured by the government or economists, with the participation of visitors and stakeholders.

Making a reliable qualitative analysis is a complicated task, since the criteria for assessing the heritage category has not been established yet. There are many factors which should be taken into account [27, 28]. Each of these factors influences the probability of heritage assessing.

2. DEMANDS TO THE ASSESSMENT METHOD

The Old Town of Vilnius is the largest in Eastern Europe. One of the most complicated problems of urban development is complex evaluation of old town buildings based on technical-economical and social-economical criteria and depending on social tasks and demands as well as the perspectives of complex structural organization and development of

a city. Old town makes a very significant part of the city centre from engineering perspectives. Therefore, the state of these districts should not be evaluated only by a commercial method, but should rely on other approaches as well.

We thinks, that a complex of technical-economical and social-economical criteria includes economical, social, historic, archaeological, architectural, demographic and other factors. Therefore, various specialists should be involved in the assessment of the state of the buildings in old districts who could analyse and investigate them and give recommendations concerning the methods of reconstruction to be used.

In order to determine the ways and methods of building and architectural development of old districts, the assessment of the quality of old architecture of the buildings as an important social-economic criterion should be made. The reconstruction, its forms and methods used in renewing separate buildings as well as old town as a whole depend on this evaluation.

The analysis of the built-up areas has shown that the old towns possess outstanding and unique beauty. Despite the fact that they have been formed in various periods of economic, social and political development and can be classified according to this principle, their architecture is integral.

Therefore, to analyse the evolution of old town reconstruction in detail, its buildings should be evaluated from various perspectives and grouped according to their historical-architectural value.

The evaluation made according to the above principle has shown to what particular architectural categories the buildings of the old town belong and what method of reconstruction can be used.

The analysis of the value scheme has shown that the consideration of old towns based on their historical-architectural categories allows us to find effective methods and ways of their regeneration aimed to preserve not only valuable buildings, but the whole specific built-up areas as well.

However, in practice, a method satisfying the most of the following constraints is selected. It should be:

- easy to understand
- capable to support the necessary number of decision makers
- capable to manage the number of alternatives
- able to handle inaccurate and uncertain information
- able to satisfy the lowest need of preferences from the decision maker

Effective assessment means having methods of assessment which address these aspects. Maintenance, conservation and development of old districts is always associated with values of heritage buildings.

Classification is a very important aspect of decision making. It is the process of assigning heritage buildings to particular classes. Claims are often made that classes in decision making are determined by particular parameters. It is hardly possible to achieve this process (process of assigning heritage projects/buildings to particular classes) without employing special techniques in multicriteria environment [5, 8, 29, 37, 40, 41]. This article presents a verbal method of determining heritage. The problem under consideration is assessing heritage buildings/projects depending on their level of risk. Formally, the problem is stated as multicriteria classification. In fact, many different methods for solving multicriteria classification problems are widely known. ORCLASS method, as an ordinary classification, was one of the first methods designed to solve these kinds of problems [31]. Then more recent methods appeared, such as DIFCLASS [32] and CYCLE methods [33].

A new way to solve the problem is offered – application of the CLARA method (Classification of Real Alternatives) [29]. The method is based on Verbal Decision Analysis approach. In this article methods of the verbal analysis are disclosed, their value is analyzed and it is indicated in what cases these methods could be used depending on their productivity. A hierarchical approach for consideration of efficiency indicators is proposed. The efficiency of the method is proved. The procedure of applying the method for the problem in question in practice is described.

3. SOLUTION OF THE PROBLEM

Many different methods for solving multicriteria classification problems are widely known are presented in this chapter [29, 32, 33, 34, 35, 37].In this chapter some most frequently used verbal ordinal classification methods are considered. All these methods belong to Verbal Decision Analysis group and have the following common features [29, 31]:

Attribute scale is based on verbal description not changed in the process of solution, when verbal evaluation is not converted into the numerical form or score.

An interactive classification procedure is performed in steps, where the DM is offered an object of analysis (a course of treatment, for example). An object is presented as a small set of rankings. The DM is familiar with this type of description, therefore he/she can make the classification based on his/her expertise and intuition.

When the DM has decided to refer an object to a particular class, the decisions are ranked on the dominance basis. This provides the information about other classes of objects related with it by the relationship of dominance. Thus, an indirect classification of all the objects can be made based on a single decision of the DM.

A set of objects dominating over a considered object are referred to as domination cone. A great number of objects have been classified many times. This ensures error – free classification. If the DM makes an error, violating this principle, he/she is shown the conflicting decision on the screen and is prompted to adjust it.

In general, a comprehensive classification may be obtained for various numbers of the DM decisions and phases in an interactive operation. The efficiency of multicriteria classification technique is determined based on the numb`er of questions to DM needed to make the classification. This approach is justified because it takes into consideration the cost of the DM's time and the need for minimizing classification expenses.

Let us consider several most commonly used methods in more detail.

ORCLASS [32, 33]. This method (Ordinal CLASSification) allows us to build a consistent classification, to check the information and to obtain general decision rules. The method relies on the notion of the most informative alternative, allowing a great number of other alternatives to be implicitly assigned to various classes. ORCLASS takes into account possibilities and limitations of the human information processing system.

Method assessment: The main disadvantage of the method is low effectiveness due to the great number of questions to DM needed for building a comprehensive classification.

CLARA [34, 35, 38]. This method (CLAssification of Real Alternatives) is based on ORCLASS, but is designed to classify a given subset rather than a complete set of alternatives (Y space). Another common application of CLARA is classification of full set with large number of exclusions, i.e. alternatives with impossible combinations of estimations. In both cases CLARA demonstrates high effectiveness.

DIFCLASS [32]. This method was the first to use dynamic construction of chains covering Y space for selecting questions to DM. However, the area of DIFCLASS application is restricted to tasks with binary criteria scales and two decision classes.

CYCLE [33]. CYCLE (Chain Interactive Classification) algorithm overcomes DIFCLASS restrictions, generalizing the idea of dynamic chain construction to the area of ordinal classification task with arbitrary criteria scales and any number of decision classes. The chain here means an ordered sequence of vectors $\langle x_1, \ldots, x_d \rangle$, where $(x_{i+1}, x_i) \in P$ and vectors x_i+1 and x_i differ in one of the components.

Method assessment: As comparisons demonstrate, the idea of dynamic chain construction allows us to get an algorithm close to optimal by a minimum number of questions to DM necessary to build a complete classification. The application of ordinal classification demonstrates that problem formalization as well as introduction of classes and criteria structuring allows solution of classification

problems by highly effective methods.The method can be successfully applied to classification of investment projects when the decision classes and the criteria used are thoroughly revised.

4. DETERMINING THE VALUES OF OLD TOWN BUILDINGS BASED ON THEIR HISTORICAL-ARCHITECTURAL CATEGORIES.

After a series of iterations all buildings were evaluated as follows:

1. Highly valuable buildings.
2. Valuable buildings.
3. Buildings of low value.
4. Non valuable buildings

A detailed description of these groups is given below:

*Group "*Historical-archaeological building value*"* is based on historical, cultural and memorial values of the remnants of buildings of particular epochs.

*Group"*Historical-architectural old town building value*"* is based on the remaining internal and façade elements of old buildings representing the stylistic features of a particular epoch.

*Group "*Architectural-compositional old building value*"* is based on façade composition and architecture as well as the building function in the 3-D urban space.

*Group "*Technical-economic values of old buildings*"* is based on construction technique and quality at the time of building evolution.

Then, the classification of the possible old town buildings' estimates should be made, taking into consideration all levels of their multi-purpose quality descriptions. At this stage, the quality of the received results should also be checked.

First, classification of the factors described at the second level is made. Quality class is a general evaluation of the first level criteria. Then, these estimates are filled with concrete meaning. In the next step, the classification of the first level factors is performed. Finally, rules for solving the problem of determining the values of the old town buildings are defined.

Decision maker can establish the class of a historical -architectural category value taking into consideration the available classification. It should be noted that only factors from the first hierarchy level might be employed. If difficulties occur while allotting evaluations, DM opens the second, more accurate level. Moreover, there is a possibility to use the second hierarchy level for separately selected first level factors.

It is offered to establish the class of a historical-architectural category value by means of the verbal analysis, using CLARA method. It is based on classification that allows old buildings to be evaluated by making a decision according to the accurately established classes, taking into consideration the respective criteria suggested for the evaluation of historical-architectural categories.

The idea of dynamic construction of the links allows acquiring an algorithm which is close to the optimal based on the minimal amounts of DM questions necessary for establishing the whole classification.

5. THE MAIN STAGES OF GAINING EXPERT KNOWLEDGE BY USING THE METHOD CLARA

The algorithm CLARA (Classification of Real Alternatives) is based on the dichotomy of the alternatives' chains, beginning with the longest chain. This concept, first used in the algorithm DIFCLASS [32, 39] and then in CLANSH [36], has been adapted for rarefied spaces *Y*. Moreover, the algorithm CLARA uses a new idea of the adaptive dichotomy allowing us to determine the boundaries between classes of solutions and make classifications much faster.

The knowledge is gained by carrying on a dialogue with an expert.

First, the main operations are outlined:

1. Discussing the statement of the problem. Defining the properties of G.
2. Generating a set of criteria K by an expert.
3. Constructing the scales for criteria evaluation. Preliminary analysis: checking if the estimates are (partially) arranged in the descending order of the distinctness of the property G.

4. Defining a set of ordered classes of solutions C by an expert.

The second stage of applying the method – expert-made classification involves submitting to an expert possible combinations of the attribute values for analysis. This is a time-consuming procedure because the number of combinations is usually large. This may entail expert's errors. Therefore, the method provides for defining some simple problems within the original classification problem by considering only two values of any attribute. Then, the results obtained are included in the original problem, and the expert solves this partially solved problem on the full scale.

In the process of classification it may become clear that some combinations of the criteria values cannot be practically realized. In this case, the objects to which they refer are excluded from the analysis by an expert.

The classification is over, when all the objects included in the analysis (a set Y*) are referred to a particular classes.

At the third stage of analysis, the boundaries of classes are checked up because an expert could make some errors. Since class boundaries are the key factors in making classifications, every class specified by the expert should be checked up. For this purpose, every boundary element is offered to the expert again for checking. At the fourth stage, the defined boundaries of the classes converted into the expert rules of solution of the form:

$$ab*** + p_n^{k_1[x_1]}, \text{ except } \{abcde, \ldots, abpqr\} \qquad (1)$$

So that every alternative should follow one rule, where *ab**** is *a fixed part* of the rule, while $p_n^{k_1[x_1]}$ is *a rearrange able part* of the rule. Here, n is equal to the number of asterisks, k_i is the number of estimates x_i involved in rearrangement. The third part is activated if a set of alternatives described by a template is not completely rearrangeable, but, to achieve this, a small number of elements is needed. Then, the missing elements are simply listed. The rules described are introduced into the system when solving the problem on a large scale and simplify the solution considerably by reducing the classification space.

The decision rules of a particular class can be represented as a two-level tree (Fig. 1):

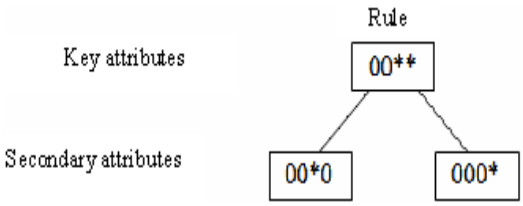

Figure 1. Decision rules of a particular class

Here the values of key attributes are found at the higher level, while the combinations of the values of secondary attributes are found at the lower level.

The rules described comply with inexplicit expert knowledge. The rules are submitted to an expert for approval. Some rules may be too complicated. In this case, the procedure of identifying a zone of superficial knowledge might be needed because complicated rules often indicate that knowledge is not stable. For this purpose, it is necessary to go back to the second stage of method application (Fig. 2).

6. CLARA (CLASSIFICATION OF REAL ALTERNATIVES)

A classificator, composed of heritage buildings evaluation criteria and final class decisions, is compiled for establishing old town buildings values classes (Fig. 3). Constructional heritage buildings evaluation criteria are provided in the first and second criteria levels. Old town buildings is evaluated taking into consideration 4 first hierarchy level criteria (Fig. 4.):

The first hierarchic level is the main one. Old buildings value can be evaluated according to the criteria of this level. Each first hierarchy level criterion is evaluated: as non valuable, of little valuable, valuable or highly valuable. When the estimates are introduced, the result is obtained, i. e. old buildings value levels are determined. These criteria (1st level) are not always sufficient for establishing the old building value level. Therefore, each criterion of the first hierarchic level is subdivided into lower level criteria. The second hierarchic level is composed in this way (Fig. 5).

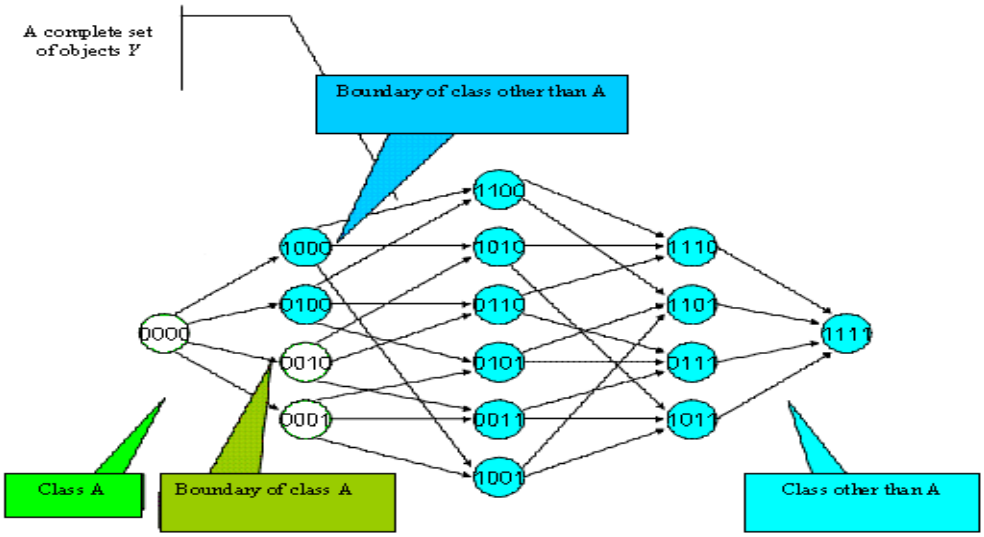

Figure 2. Example of method application

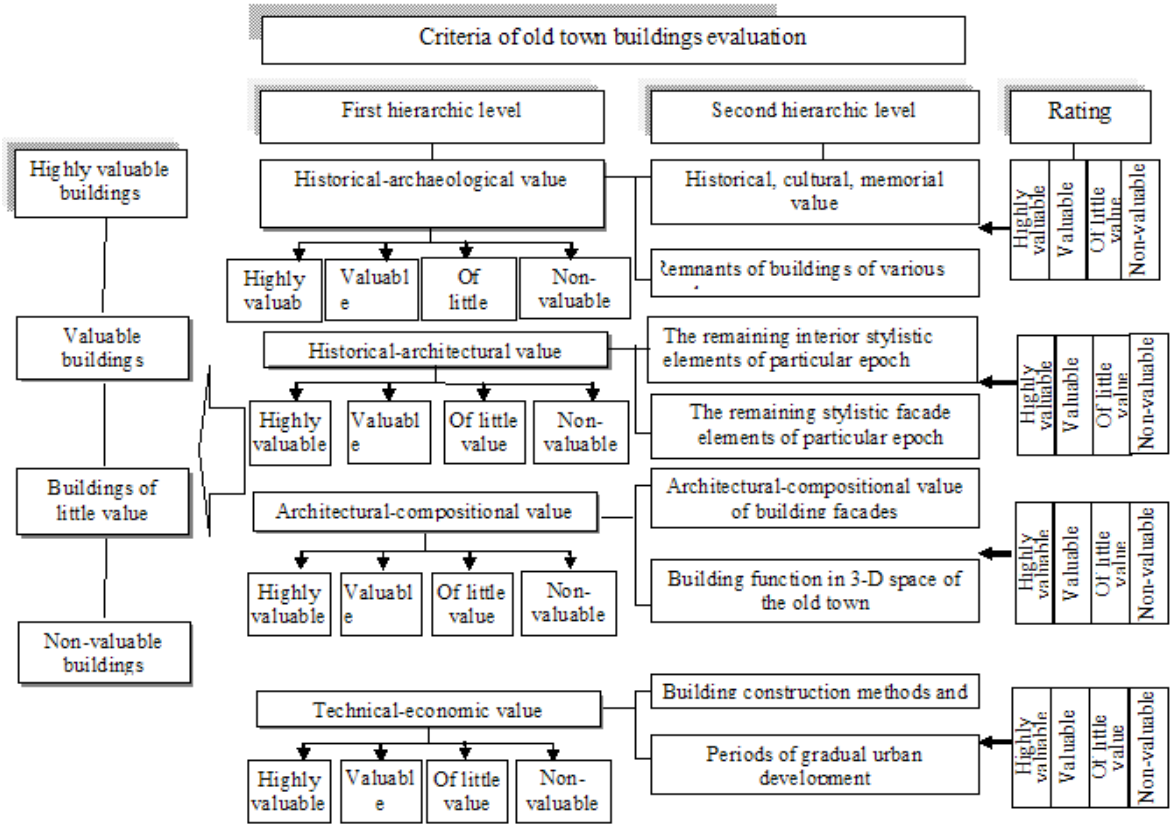

Figure 3. Classificator of old town buildings' values

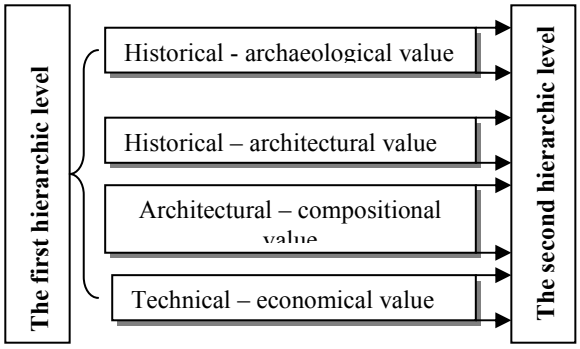

Figure 4. The first hierarchy level

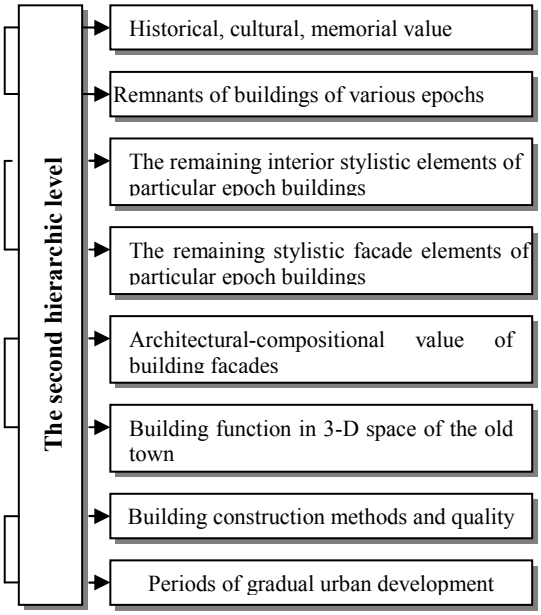

Figure 5. The second hierarchic level

The criteria of the second hierarchic level are required for performing an accurate analysis (each of the old building values types is analysed) [30].

Classificator establishment course. Data input into the program.

1 STAGE. Historical - archaeological value (Fig. 6)

For second hierarchy level evaluation criteria are introduced:

- Criterion 1 – Historical, cultural, memorial value.
- Criterion 2 – Remnants of buildings of various epochs.

Criteria evaluation classes:

- Class A –highly valuable;
- Class B –valuable;
- Class C – of little valuable;
- Class D – non valuable.

While analysing two projects (2 alternatives) the expert determines where the historical, cultural, memorial value is qualified enough, where remnants of buildings of various epochs are non valuable. After the alternative is analysed, it is determined if there are no mistakes in it.

2 STAGE. Historical – architectural value assessment (Fig. 7)

- Criterion 1 – The remaining interior stylistic elements of particular epoch buildings
- Criterion 2 – The remaining stylistic facade elements of particular epoch buildings

Criteria evaluation classes:

- Class A –highly valuable;
- Class B –valuable;
- Class C – of little valuable;
- Class D – non valuable.

3 STAGE. Architectural – compositional value.

- Criterion 1 – Architectural-compositional value of building facades;
- Criterion 2 – Building function in 3-D space of the old town.

Criteria evaluation classes:

- Class A –highly valuable;
- Class B –valuable;
- Class C – of little valuable;

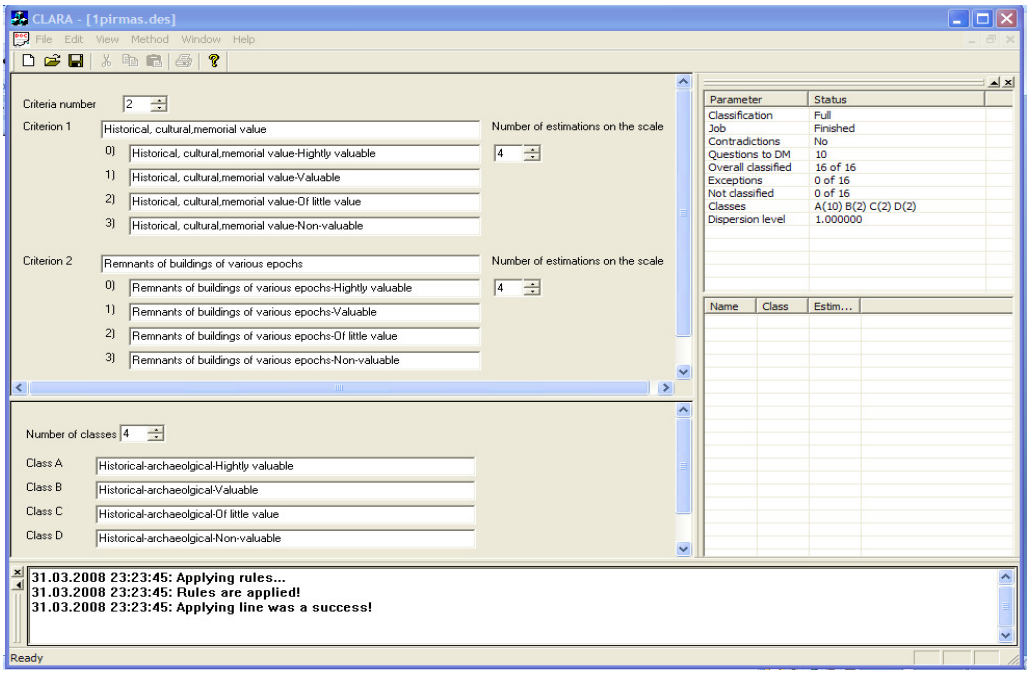

Figure 6. Historical - archaeological value assessment

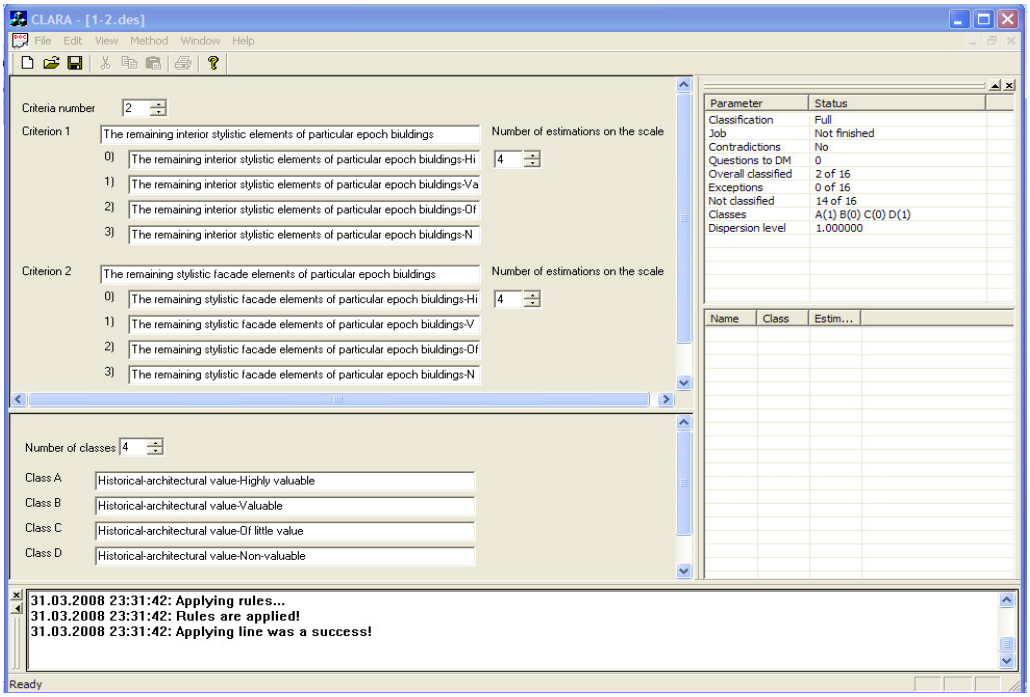

Figure 7. Historical – architectural value assessment

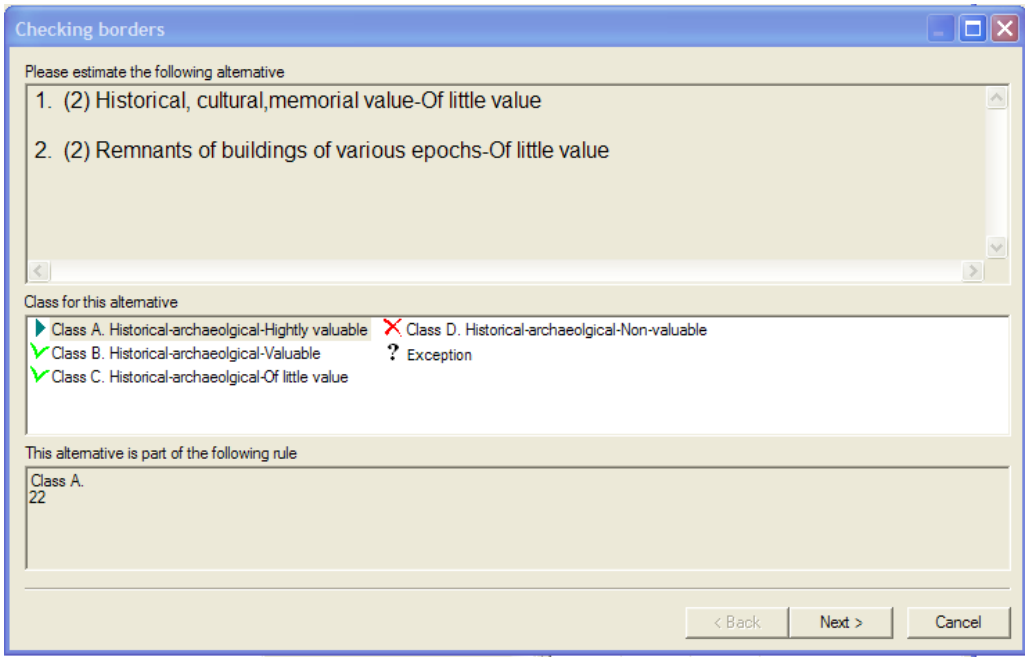

Figure 8. Assessment of alternative

- Class D – non valuable.

4 STAGE. Technical – economical value.

- Criterion 1 – Building construction methods and quality
- Criterion 2 – Periods of gradual urban development.

Criteria evaluation classes:

- Class A –highly valuable;
- Class B –valuable;
- Class C – of little valuable;
- Class D – non valuable.

Classification is performed when verbal risk evaluation scheme data are put into the program

Classification implementation in the program

After introducing all the criteria that will be taken into consideration while evaluating two old town buildings, the last stage is performed, i. e. the criteria are compared.

The comparison (Fig. 8) is made in the following way: the program selects one evaluation of each criterion and composes their combinations. The expert assigns the available evaluation combination to the respectful class.

For example, if such a combination is put into the program:

(2) Historical, cultural, memorial value – Average.

(2) Remnants of buildings of various epochs – Average.

The expert allots it to class A – high evaluation.

When the assigning is finished, a transfer is made to the next stage (by pushing the button "NEXT"). Another evaluation combination is provided. This is done up to a moment, until all the combinations are allotted to the respectful class.

During the work the expert might make a mistake or change his opinion, therefore, contradictions might appear in his answers.

In such case, the program shows a warning that contradictions have occurred and it will ask to confirm the new answer or to change it.

If program CLARA is used, all the contradictions are eliminated during the work.

After the work is finished, the program saves all the data, performs analysis and shows the number of the given DM questions, the number of classified combinations and the number of eliminated combinations. It also shows how many of the evaluated combinations were allotted to classes A, B or C (Fig. 9).

Evaluations of all second hierarchy level criteria are established in an analogous way.

In our case, five available files are processed, the usage of which helps to establish the first and the second levels of investment project risk.

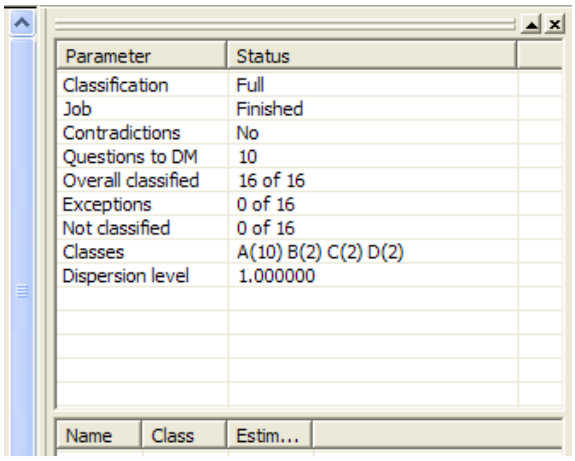

Figure 9. The data of program

Final solving analysis

The final analysis is performed according to the evaluations of the first hierarchy level. After the final analysis is performed we get evaluation data of both projects/old town buildings, i. e. we establish their values.

We have four first hierarchy level criteria. Criteria evaluation classes:

- Class A – Highly valuable buildings;
- Class B – Valuable buildings;
- Class C – Buildings of low value;
- Class D – Non valuable buildings;

Evaluation combination of the first project according to the II hierarchy level evaluations (Fig. 11):

- Historical - archaeological value – Highly valuable
- Historical – architectural value – valuable;
- Architectural – compositional value – of little value;
- Technical – economical value – valuable;

Result: according to such evaluations this old town building can be allotted to class B – Valuable buildings.

7. CONCLUSIONS

In project development, it is hardly possible to get exhaustive and accurate information. As a result, the situations occur, the consequences of which can be very damaging to the project. Due to close cooperation of the participants the old building value occurring at one stage of the evaluation can be transferred to other stages and one type of old building value can be changed by another. This means that chain reaction is characteristic of the old building value, thereby decreasing the value of any project.

The values of the old town buildings can be effectively determined by using the method CLARA. This method allows us to classify and evaluate all old buildings according to their historical-architectural categories. A method suggests an algorithm helping us to reduce the number of questions to the DM to a minimum.

Classificator provided in the article is the main rule for making decisions, evaluating the old town buildings. It joins factors that have influence upon the probability of risk.

Figure 10. Data base (I hierarchy level of the building)

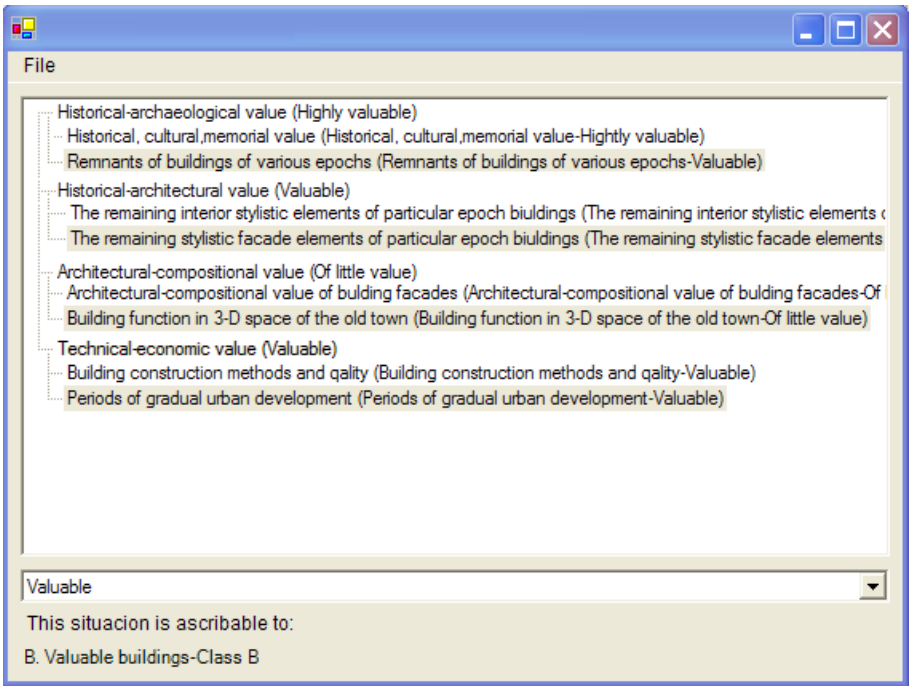

Figure 11. Data base (II hierarchy level)

Criteria of the classificatory and the evaluations are introduced into verbal decision analysis support system CLARA, which allows to perform criteria combination classification rather quickly. After all the above mentioned actions are performed, the person who wants to evaluate the building, it is enough to introduce the respectful evaluations into the composed program data base and the program will provide the result – the building value.

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