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SELECTION OF RATIONAL DISPUTE RESOLUTION METHOD BY APPLYING NEW STEP-WISE WEIGHT ASSESSMENT RATIO ANALYSIS (SWARA)

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Abstract. The paper considers major principles of application of the multi-attribute systems to solve legislative tasks. In order to assess dispute resolution methods from economic, social and other points of view, it is necessary to apply methods for assessing solutions according to multiple attributes. All known multi-attribute methods cannot value the atribute weights as one weight of attribute is higher or lower significant than the other attribute. The new step-wise weight assessment ratio analysis method (SWARA) allows including experts, lawyers or dispute parties opinion about significance ratio of the attributes in the process of rational decision determination. SWARA method could be applied in practical implementation of specialised decision support systems and alternative dispute resolution in virtual environment. Starting with principles and established approaches, a problem-structuring methodology was developed which would condition the problem to allow a more thoughtful application of existing decision-making analytic methodologies.

Keywords:SWARA, dispute resolution, decision-making, ratio analysis.

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1. Introduction

Disputes are a reality in every business project. If the parties cannot reach a resolution themselves, expensive, time-consuming legal procedure begins, which severely affects all the participants. Conflict analysis and resolution play an important role in business, governmental, political and lawsuits disputes. The sooner the conflict can be identified and addressed, the higher the percentage of resolution success and the lower the cost. Principles including government laws, industrial self-regulation, and contracts agreed by parties involved should be the basic guidelines to attain a fair and justified solution (Xu and Yuan 2008). If the dispute cannot be settled amicably, the parties can go to court or consider other dispute settlement procedures such as mediation, conciliation, etc. Recently, in countries of both general and continental traditions of law one can note increasingly active interest of researchers in alternative

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methods of dispute resolution (Bingham 2002; Chan and Suen 2005; Koolwijk 2006; Gebken and Gibson 2006; Gabuthy *et al.* 2008; Ma *et al.* 2008).

In global practice, the following alternative dispute resolution methods are considered to be the main ones:

1) Mutual negotiations of parties without mediators.
2) Conciliation procedure, the purpose of which is to achieve that parties end their dispute by a peace agreement; the conciliation procedure may be performed by a person selected by the parties, a judge or other civil servant.
3) Transfer of dispute for solution by an expert selected by the parties, for example, for determination of building defects or amount of remuneration.
4) Examination of dispute with participation of lawyers of the parties and a mediator (mini-trial).
5) Mediation – negotiations between parties with mediation of a selected person.
6) Arbitration – dispute of parties is solved with the help of arbiters (*ad hoc* arbitration) or the dispute resolution is organised by a permanent institution (institutional arbitration).

The definition of alternative dispute resolution is constantly expanding to include new techniques.

In each particular case analysis of negative and positive features of various dispute resolution methods allows evaluating the perspective of judicial litigation and application of other dispute resolution methods. Such knowledge allows reasonably and deliberately to select the most suitable method for dispute resolution – litigation in court, arbitration, mediation, etc. Private conflict resolution methods, of which the most frequently used are negotiation, mediation and arbitration, are considered as alternative dispute resolution methods. While resolving disputes in any of the methods mentioned by using administrative or organizational leverage, it is sought to affect circumstances and stimulate the dispute parties to agree constructively.

Determination of rational method for dispute resolution is an issue of special relevance. This is so because of a few reasons: first of all, resolution of disputes requires complex legal, technological, engineering, economic, etc. knowledge; secondly, disputes frequently stop development of business projects; thirdly, for disputes parties it is very important that their disputes have a minimum impact on their amicable business relations in future. Problems of rational dispute resolution generally are large and complex, involving many interested parties, often with sharply differing beliefs and values.

It is an extremely important decision of the dispute to justify the choice to find a rational option. Disputes may prevent further cooperation, the implementation of business projects development , etc. Parties, which are included in the dispute, in order to select the most preferable way of a dispute resolution method, are facing with a choice problem,i.e. which procedure is the best for decision-making. Which is the appropriate method for resolving or managing a conflict? There are mainly two aspects in which conflict managing methods differ in their design (Rauschmayer and Wittmer 2006):

– the extent and form of deliberation, and
– the extent and form of scientific analysis within the process.

Since making of legal decisions is usually based on logical analysis of circumstances and facts related to a dispute, mathematical calculations can successfully be applied for substantiation of these decisions (Bench-Capon and Prakken 2008). The assessment of rational dispute resolution method is no exception.

There are quite many researchers dedicated to dispute resolution by applying mathematical methods. Cheung and Yiu (2007) mathematically described mediation process in construction. Kronaveter and Shamir (2007) proposed a solution model for long-lasting conflicts over international waters. Rauschmayer and Wittmer (2006) stated, that the combination of deliberative and analytical methods has a high potential for the resolution of environmental conflicts. However, selecting methods and tools for a specific case often remains nebulous. They described the resolving environmental conflicts by combining participation and multi-criteria analysis. Chan *et al.* (2006) presented a dispute resolution selection model based on the analytical hierarchy process and multi-attribute utility technique (MAUT). Goltsman *et al.* (2009) compared three common dispute resolution processes – negotiation, mediation, and arbitration. It is stated that unmediated negotiation performs as well as mediation if and only if the degree of conflict between the parties is low. Wang stated that disputes may be placing increasing reliance on technology for the conduct of e-commerce and dispute resolution has raised fresh questions about both decision-making and dispute resolution (Wang 2009). Disputes can be more complex when shared interpretations cannot be assumed. Legal concepts and political systems can vary greatly, requiring multi-dimensional resolution.

Application of decision support systems for solution of various legal issues was analysed in works of numerous authors (Arditi and Tokdemir 1999; Guerrero and Pino 2008; Kaplinski 2007; Mitkus and Šostak 2008; Mitkus and Trinkūnienė 2008). Possibilities to apply the game theory in law received large attention from Miceli (2004). In spite of this, there is a lack of scientific research that could substantiate decisions of parties when selecting the most rational way of dispute resolution. In works of Lithuanian authors, the application of solution support systems is also directed towards solution of other economic or construction process management problems (Banaitienė *et al.* 2008; Ginevičius 2009; Ginevičius and Zubrecovas 2009; Kaklauskas *et al.* 2008; Keršulienė and Urbanavičienė 2007; Liaudanskiene *et al.* 2009; Turskis 2008).

2. Application of multi-attribute evaluation methods for selection of rational dispute resolution method

Since, in case of a dispute, parties usually have opposite goals, and,moreover, each of the parties simultaneously strives for not a single but multiple goals (expediency, economic value, confidentiality, etc.), in assessing the possible methods of dispute resolution, it is necessary to select attributes that specify the process, which includes dispute resolution and decision implementation procedures. After attributes selecting it is necessary to determine which of them are significant for the dispute parties, to search

data illustrating each attribute and create a transaction model. However, the choice of dispute resolution, the objective defines a number of attributes (confidentiality, efficiency, maintenance of friendly relations, economic efficiency, etc.). So the problem becomes the matching of these attributes meanings, which are often contradictory. The simplest case tries to combine all attributes into one general.

There are more advantageous mathematical methods for determining the general attribute as they can help evaluate the weight of the attributes. The general attribute determined by these ways would be ideal if it were possible to specify the weight of the attributes. Usually, the parties may only make very abstract points on the weight of each attribute, therefore, the solicitor or another person responsible for decision-making must individually define the possible limits of the attribute.

However, the determining of the rational method of dispute resolution for decision-making is quite a sophisticated process and can rarely be evaluated by the same general attribute.

Our values, beliefs and perceptions are forces behind almost any decision-making activity. They are responsible for the perceived discrepancy between the present and a desirable state (Brauers *et al*. 2008). Especially in dispute resolution, the diversity of objects, hardly commensurable variables, conflicting objectives and constraints characterise contemporary decision problems. Different parties with different interests and values make a decision-making process on different decision alternatives even much more complicated. In the Multi-Attribute Decision-Making (MADM) context, the evaluation of each alternative on the set of objectives facilitates the selection. Attributes provide the basis for a comparison of the alternatives and consequently facilitate the selection. Therefore, multi-attribute techniques seem to be an appropriate tool for ranking or selecting one or more alternatives from a set of the available attributes based on the multiple, sometimes conflicting, attributes.

The objectives must be measurable, even if the measurement is performed only on the nominal scale and their outcomes must be measured for every decision alternative. MADM frameworks vary from simple approaches, requiring very little information, to the methods based on mathematical programming techniques, requiring extensive information on each objective and the preferences of the stakeholders. Different publications present various classifications of the above-mentioned methods, but it is still a problem of choosing an appropriate method in a given situation. Considering the nature of information available to decision makers, MADM can be divided into the following groups (Ustinovichius *et al*. 2007; Brauers *et al.* 2008):

a) The method of rank correlation consisting of totalising ranks is the first method to be considered. Rank correlation was first introduced by psychologist Spearman (1904) and later taken over by statistician Kendall (1970). Ginevicius *et al.* (2008), Zavadskas and Vilutienė (2006), Zavadskas *et al.* (2009) applied this method for construction problems solution.

b) The methods based on quantitative measurements using a few attributes to compare the alternatives (comparison preference method). This group consists of the prefer-

ence comparison methods like ELECTRE (Roy 1996; Ulubeyli and Kazaz 2009) and PROMETHEE (Behzadian *et al.* 2010; Podvezko and Podviezko 2010).

c) The methods based on initial qualitative assessment, the results of which take a quantitative form at a later stage. This group consists of the analytic hierarchy process (AHP) methods (Saaty 1977; Podvezko 2009; Maskeliūnaitė *et al.* 2009) as well as of the methods based on game theory (Peldschus 2008) and fuzzy sets (Plebankiewicz 2009). Peldschus and Zavadskas (2005) proposed fuzzy matrix games multi-attribute model for decision-making in engineering, Zavadskas and Turskis (2008) suggested and applied the logarithm normalization method in game theory for multi-attribute construction problems solution, Ginevičius and Krivka (2008) applied the game theory for duopoly market analysis.

d) The methods based on a reference point or goal such as the Reference Point Method which is used in TOPSIS (Hwang and Yoon 1981; Zavadskas *et al*. 2006; Antuchevičienė *et al.* 2010), VIKOR (Opricovic and Tzeng 2004), COPRAS-G (Zavadskas *et al.* 2008), MOORA (Brauers and Zavadskas 2006) and Goal Programming (Lee 1972).

Therefore most of the above mentioned methods do not illustrate the ratio between utility functions of problem solution. It can easily be done by applying SAW method (MacCrimon 1968; Jakimavičius and Burinskienė 2009; Ginevičius and Podvezko 2008) with little modifications.

One of the simplest approaches is based on the principle: the utility function of alternative is calculated according to the ratio product of maximising attributes values to the product of minimising attributes values (similar like MULTI MOORA, Brauers and Zavadskas 2010).

The examples of maximising dispute resolution attributes: assurance of confidentiality, satisfaction of parties with dispute outcome, freedom of parties to handle the dispute, preservation of amicable interrelations, etc., and examples of minimising attributes: expedition of dispute examination, price of dispute resolution, etc.).

The most of above presented methods include significance of each attribute. In real case parties of the dispute have their own opinion about attributes, weights, and differences of the weights are essential.

3. A new step-wise weight assessment ratio analysis (SWARA) technique

Each specialised decision-making support system for selection of the rational dispute resolution method should have four main groups of regulations and procedures:

- Generating of feasible alternatives to dispute resolution;
- Formation of attributes systems describing alternatives, meanings and importance. This category includes sets of rules that present an attribute system describing alternative, attributes meanings and importance of formed alternatives;
- Having set priority, degree of usefulness and value of alternatives, rules of subsystem would offer the alternatives that are worth to be analyzed further and why.

The main goal of a set of such rules is to set the most rational options of dispute resolution basing on attributes specified below:

a) sum of money that a party is ready to pay for dispute resolution,

b) priority and degree of usefulness of options of dispute resolution,

c) reliability of alternatives basing on precedents of analogical disputes;

- Generation of proposals to the interested parties of the dispute, which alternatives are the best and can be investigated in future.

The Multi-Attribute expert system for dispute resolution can be described as shown in Figure 1.

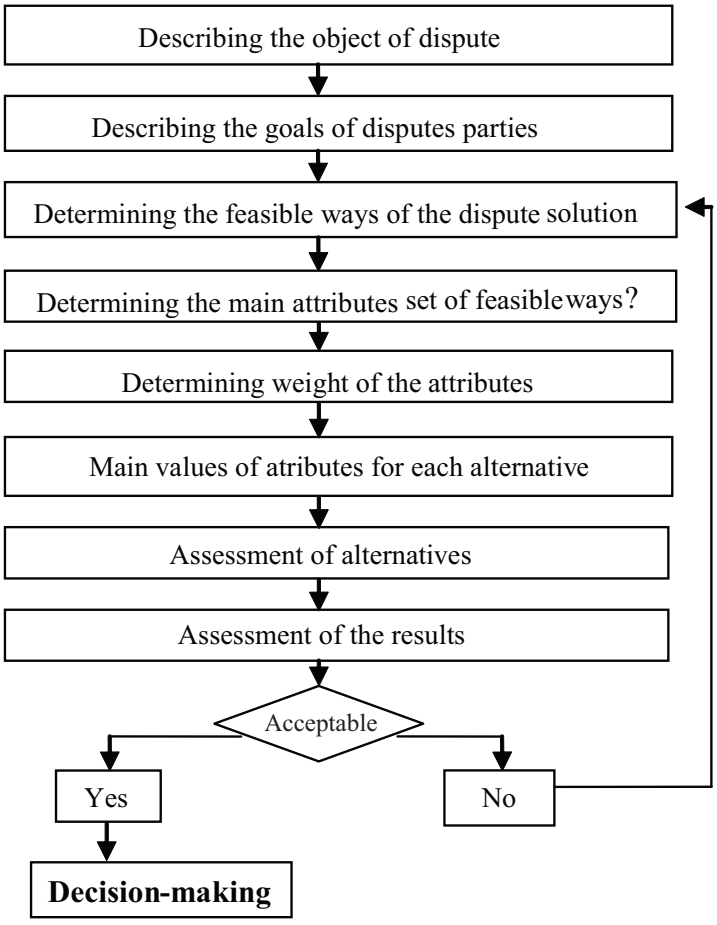

Fig. 1. The Multi-Attribute expert system for dispute resolution

There are different ways to determine values of attributes and their weights. There are objective, subjective, and integrated weights of the attributes. Only well-founded weighting factors should be used because weighting factors are always subjective and influence the solution.

The weights of attributes can be determined by applying:
- Subjective methods (AHP – *Analytic Hierarchy Process*;
- expert judgment method based on the expert questioning);
- Objective methods (*Entropy*);
- Integrated methods (which are combination of several methods).

To determine the weights of the attribute, the expert judgment method is proposed by Kendall (Kendall 1970; Fisher and Yates 1963; Zavadskas 1987; Zavadskas *et al.* 2010). The concordance coefficient W and the respective values of the statistic χ^2 should be calculated.

One of the most popular methods is pair-wise comparison for determining the weights of the attributes. This method (AHP) is suggested by Saaty (1977). The method AHP evaluation may be considered sufficiently reliable only if the judgements of experts are in concordance. The values degree of consistency should be calculated (Zavadskas and Vilutiene 2006; Ginevičius and Ginevičienė 2009). The use of the DELPHI method can contribute to harmonising the estimates (Kendall 1970).

There are a lot of methods of determining objective and integrated weights of attributes. The attribute weight is obtained based on privileged data and vector technique (Saaty 1977), least squares comparison (Chu *et al.* 1979), Delphi (Hwang and Lin 1987), LINMAP – Linear Programming Techniques for Multidimensional Analysis of Privileged (Srinivasan and Shocker 1973). The latter technique uses mathematical programming for obtaining weights without privileged data, involving Entropy (Hwang and Yoon 1981).

Subjective and objective approaches have a number of advantages and disadvantages. The weights obtained by a subjective approach reflect subjective judgment of a person resulting in ranking of the alternatives of the particular problem. Objective weights are obtained by mathematical methods based on the analysis of the initial data. A number of papers aimed to combine subjective and objective approaches to solve MADM problems have been published (Ustinovichius *et al.* 2007).

Zavadskas (1987) and other authors (Ustinovichius *et al*. 2007) suggest that the formula for determining the integrated weight of the attributes can be interpreted as follows:

$$\overline{w}_j = \frac{w_j^* w_j}{\sum_1^n w_j^* w_j}; \sum_{j=1}^{n} \overline{w}_j = 1; j = 1,2,...,n, \quad (1)$$

where w_j^* – objective weight of the j attribute; w_j – subjective weight of the j attribute; $\overline{w}_j$ – integrated weight of the j attribute.

However, according to the above mentioned methods the attribute weights cannot be valued as one weight of attribute is higher/lower significant than the other attribute, because attributes are ranked according to preferences of expert decision- making.

The new procedure for the attributes weights determination which provides the opportunity to estimate the differences of their significances can be described as presented in Figure 2.

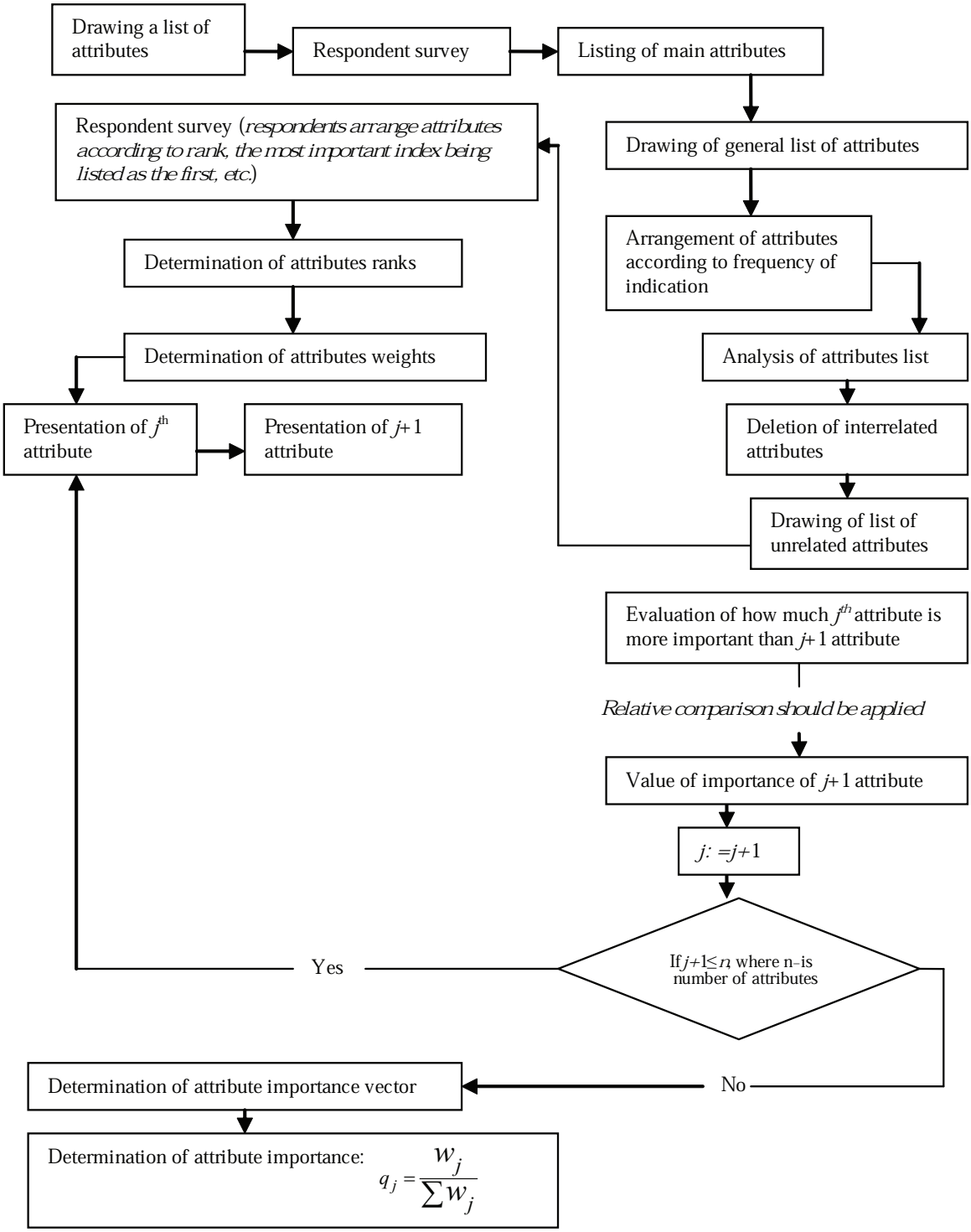

Fig. 2. Determining of the attribute weights

As mentioned, the main feature of SWARA method is the possibility to estimate experts or interest groups opinion about significance ratio of the attributes in the process of their weights determination.

4. Dispute resolution methods and Lithuanian case study

In Lithuania, the main institutions of trying court disputes are considered to be the courts of general competence. Each party of dispute has a right for court dispute resolution guaranteed by Articles 30 and 109 of the Constitution of the Republic of Lithuania (1992), Article 5 of the Civil Process Code of the Republic of Lithuania (2002) as well as Article 6 of Convention for the Protection of Human Rights and Fundamental Freedoms (1950) that is validated in Lithuania. Court dispute resolution methods frequently stimulate to choose a typical form of agreements, which generally specifies that "disputes originating shall be resolved in court" or "disputes originating shall be resolved in the order specified in the laws of the Republic of Lithuania".

Though judicial litigation requires quite large financial expenses and time costs, alternative methods of dispute resolution are not widely applied in Lithuania, in spite of huge mistrust in judicial system as seen in society. Most often the parties do not even consider the possibility to choose an alternative for judicial solution of a dispute. Furthermore, a significant percentage of participants of court-investigated disputes in the country are not satisfied with courts. However, having the scope of litigation increasing rapidly and an opinion about crisis of jurisdiction system spreading, it should be expected that in the nearest future Lithuanian law practice will have more space for alternative dispute resolution methods.

Alternative dispute resolution methods existing in addition to the judicial method as common in today's society emerged immediately when courts became the only institution dispensing justice in the State. Dispensation of justice takes place by means of announcement, on behalf of the State, which party of a dispute is right and which is not. Frequently parties of a dispute are not interested, due to multiple reasons (unnecessary publicity, protection of *know how* or trade secrets, reputation, etc.), for the State to interfere into their dispute and, even to greater degree, to announce who is the winner and who is the loser.

It must be emphasised that most legal relations arise on initiative from process participants and not from State institutions. These relations are characterised by dispositive method of regulation: the parties themselves establish their rights and obligations, and then ensure and implement them. Therefore it would not be fair for a State to forbid these participants of civil relations to settle their mutual disputes by themselves.

Speaking about alternative dispute resolution methods in Lithuania, it should be noted that such dispute resolution methods are not regulated and not stimulated by Lithuanian legal acts, although 2000–2004 program of the Government of the Republic of Lithuania specifies that "alternative dispute resolution methods, such as arbitration, mediation, will be supported <…>". Despite the many hybrid forms of alternative dispute resolution methods, without a judicial resolution of the disputes in Lithuania only three are really used – negotiation, arbitration and mediation. Because of that, it is most advisable to make the choice of rational dispute resolution methods from these alternatives.

As survey of "Norcous & Partners" (2007) lawyers' office and Vilnius Commercial

Arbitrage Court demonstrate, respondents indicate quite a number of attributes that they consider to be more or less important in selection of dispute resolution method. For determining attribute weights by SWARA method (Fig. 3), authors offer to perform calculations only according to 6 most important attributes (Fig. 4).

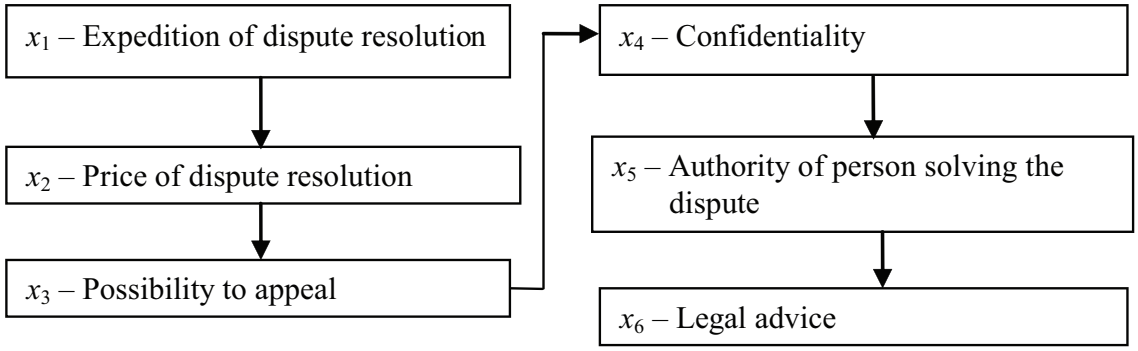

Fig. 3. Determination of attributes ranks

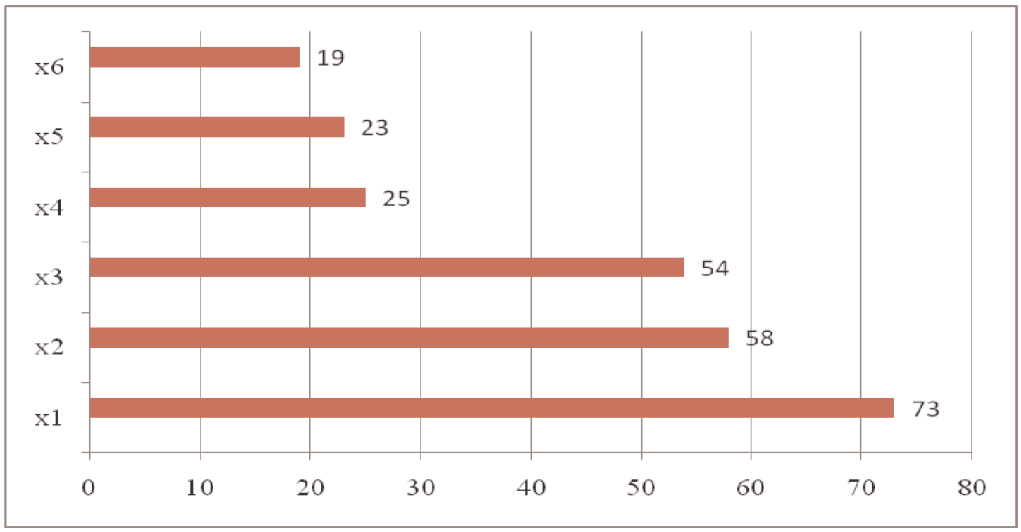

Fig. 4. Most important attributes in selection of dispute resolution method

Calculation results by SWARA method are shown in the table of attributes describing dispute resolution methods and their parameters (Table 1).

Results of conducted calculations (sequence of attribute ranks: expedition of dispute examination, price of dispute resolution, possibility to appeal, assurance of confidential - ity, authority of person solving the dispute, legal advice): $w_1 = 0.22$; $w_2 = 0.19$; $w_3 = 0.18$; $w_4 = 0.14$; $w_5 = 0.14$; $w_6 = 0.13$.

Calculations have shown how this methodology can be applied in practice for determining attribute weights estimating how much one weight of attribute is higher/lower significant than the other attribute.

Table 1. Attributes Describing Resolution Methods and Their Parameters

Attribute	Comparative importance of average value s_j	Coefficient $k_j = s_j + 1$	Recalculated weight $w_j = \frac{x_{j-1}}{k_j}$	Weight $q_j = \frac{w_j}{\sum w_j}$
Expedition of dispute resolution x_1		1	1	0.22
Price of dispute resolution x_2	0.15	1.15	0.87	0.19
Possibility to appeal x_3	0.04	1.04	0.84	0.18
Assurance of confidentiality x_4	0.29	1.29	0.65	0.14
Authority of person solving the dispute x_5	0.02	1.02	0.64	0.14
Legal advice x_6	0.04	1.04	0.61	0.13

There are no systems satisfying needs of conflicts parties that could be applied for selection of dispute resolution method and dispute resolution yet created in Lithuania.. It is proved that for successful selection of rational method for dispute resolution Multi-Attribute alternative assessment can be applied. Multi-Attribute system based on SWARA could be applied in practical implementation of specialised decision support systems and alternative dispute resolution in virtual environment.

So far there are no courts in the world that would completely (from beginning to end) settle proceedings in virtual environment (*online*) and would make a decision of behalf of a State, but the number of international arbitrations able to transfer dispute resolution to virtual environment is increasing. When solving minor disputes, attempts will always be made to apply summary procedures, characterised by expedition, low costs and efficiency. Internet offers perfect opportunities to achieve these goals.

5. Conclusions

In this research the main principles of multi-attribute assessment to solve legislative tasks are presented. It is grounded that the multi-attribute decision-making system provides excellent possibilities for determination of rational dispute resolution method.

In each specific case, having analysed negative and positive qualities of various dispute resolution methods,the perspective of litigation in court and applying other dispute reso-

lution methods can be assessed. Such knowledge allows to perform well-grounded and conscious selection of the most effective method for specific dispute resolution - litigation in court, arbitrage, mediation, etc.

It is proved that for successful selection of rational method for dispute resolution the attributes weight determining based on SWARA method and initial decision-making matrix normalised by applying linear normalisation method can be applied.

The proposed methodology allows the assessment of differences of attribute significances which characterise the decision alternatives. Calculations have shown how this methodology can be applied in practice according to the choice of rational dispute resolution method.

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RACIONALAUS GINČŲ SPRENDIMO BŪDO NUSTATYMAS TAIKANT NAUJĄ KRITERIJŲ SVORIŲ NUSTATYMO METODĄ, PAGRĮSTĄ NUOSEKLIU LAIPSNIŠKU PORINIU KRITERIJŲ SANTYKINĖS SVARBOS LYGINIMU

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Santrauka

Darbe nagrinėjami daugiakriterinės analizės taikymo galimybės ir principai teisiniams uždaviniams spręsti. Siekiant ekonominiu, socialiniu ar kitu aspektu įvertinti ginčų sprendimo būdų alternatyvas, būtina taikyti metodus, įvertinančius šias alternatyvas apibūdinančius kriterijus. Tačiau visi žinomi daugiakriteriniai metodai nevertina, kiek rodikliai, apibūdinantys alternatyvas, yra vienas už kitą svarbesni ar ne tokie reikšmingi. Pasiūlytas naujas kriterijų svorių nustatymo metodas, pagrįstas nuosekliu laipsnišku poriniu kriterijų santykinės svarbos lyginimu (angl. *Step-Wise Weight Assessment Ratio Analysis* – SWARA), leidžia priimant sprendimus įvertinti ekspertų, advokatų ar ginčo šalių nuomonę apie rodiklių reikšmingumų skirtumus. SWARA metodas gali būti taikomas kuriant specializuotas sprendimų paramos sistemas, skirtas racionaliam ginčų sprendimo būdui parinkti ar ginčams spręsti alternatyviais būdais virtualioje aplinkoje. Darbe trumpai apžvelgti ginčų sprendimo būdai, sukurtas jų vertinimo ir lyginimo metodas, kuris sėkmingai galėtų būti taikomas ir kitiems uždaviniams spręsti.

Reikšminiai žodžiai: SWARA, ginčų sprendimas, sprendimų priėmimas, rodiklių vertinimas.

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