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EVALUATING THE NEGOTIATION TEMPLATE WITH SIPRES – A FUSION OF THE REVISED SIMOS' PROCEDURE AND THE ZAPROS METHOD

Abstract

In a negotiation process, building a negotiation offer scoring system consistent with the preferences of the decision-maker is a very intricate task. A variety of methods can be used to develop such a negotiation support tool, e.g. SAW and TOPSIS, but they have several disadvantages.

In this paper the issue of evaluating the negotiation template using a novel tool called SIPRES is discussed. The algorithm proposed employs the key notions of the revised Simos' procedure and ZAPROS method to elicit the negotiator's preferences over some reference solutions. On the one hand, it allows decision-makers to define their preferences in a simple and effortless way and provides a straightforward yet effective method for analyzing the trade-offs between the alternatives using selected reference alternatives only (the ZAPROS-like approach). On the other hand, the revised Simos' procedure applied in the method allows determining the cardinal scores for the alternatives. The scoring system obtained this way makes it possible to conduct a sophisticated symmetric and asymmetric negotiation analysis.

An illustrative example presented in the paper concerns the European Union's multiannual financial framework negotiations.

Keywords: European Union, multiannual financial framework (MFF), negotiations, MCDA, revised Simos' procedure, VDA, ZAPROS, SIPRES.

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1 Introduction

The theory of negotiation recommends a comprehensive preparation before negotiations commence (Stein, 1989; Zartman, 1989; Simons, Tripp, 2003) as preparation is one of the most important factors for a successful outcome. It includes recognizing the negotiation problem, knowing your needs and limits and understanding what the other party wants and anticipating their limits. It also includes the evaluation of the negotiation template.

The negotiation template describes the structure of the negotiation problem and is defined by a list of negotiation issues and their feasible options. On the basis of this list a set of potential negotiation offers may be identified by finding various combinations of options for all the issues considered. Since comparing the offers that are described by many different criteria is, in general, not easy, a negotiation offer scoring system is usually built to support negotiators in their role. This system assigns scores to the offers within the template and in doing so makes the comparisons less difficult.

Although various MCDM/A methods can be used to build a negotiation offer scoring system (see, e.g., Figuera et al., eds., 2005 and Yoon, Hwang, 1995), such a system is usually determined using SAW – simple additive weighting method[1] (Keeney, Raiffa, 1976) (for applications see, e.g., Kersten, Noronha, 1999; Schoop et al., 2003; Thiessen, Soberg, 2003). Nevertheless, recent experimental research on electronic negotiations (Wachowicz, Kersten, 2009; Wachowicz, Wu, 2010) showed that only few negotiators are able to interpret correctly the utility values and compare effectively the quality of the offers described by SAW-based scores. According to another experiment (Roszkowska, Wachowicz, 2014b), negotiators turned out to be inconsistent in evaluating and choosing the SAW-based rankings of offers that match their preferences since most of them evaluated as more useful (better) a predefined ranking that was less similar to their own subjective ranking. Another experimental study on MCDM

[1] Apart from SAW, in order to develop a negotiation support tool in the form of a negotiation offer scoring system, other methods can also be used, e.g. AHP (Saaty, 2006; Saaty, Vargas, 1991), TOPSIS (Hwang, Yoon, 1981) or MARS (Górecka et al., 2014). However, they all have some drawbacks. For instance, the application of the technique based on AHP, which is used in Web-HIPRE system (Mustajoki, Hämäläinen, 2000), where negotiators use a nine-point verbal scale and pair-wise comparisons of the elements of the negotiation template, is limited to support discrete negotiation problems only. Moreover, pair-wise comparisons may be very tedious, which is also the case in the MARS approach. Finally, the application of TOPSIS to the evaluation of the negotiation template (Roszkowska, Wachowicz, 2015; Wachowicz, Błaszczyk, 2013) limits the possibilities of defining individual preferences by the negotiators, since the concept of distance measuring to appraise the attractiveness of offers is applied there (Górecka et al., unpublished).

by Roszkowska and Wachowicz (2014a) showed that the decision-makers (DMs) often describe their preferences qualitatively, in a verbal or visual way and that they define the reference points vaguely using imprecise and qualitative categories. On the other hand, quantitative methods and models are widely used in negotiation support to elicit the negotiators' preferences and build a negotiation offer scoring system (Kersten, Noronha, 1999; Raiffa et al., 2002). It must be kept in mind that the quantitative approach is crucial in the negotiation analysis as it allows performing different analyses of the negotiation process, for instance: measuring the scale of concessions, visualizing the negotiation progress, searching for the improvements in the contract negotiated by the parties, finding the arbitration (fair) solution of the negotiation problem, and producing general conclusions of descriptive nature (Filzmoser, Vetschera, 2008; Kersten et al., 2014).

Taking all that into account it would be worth developing a tool for evaluating the negotiation template that would allow negotiators to define their preferences qualitatively but would result in a cardinal scoring system – a helpful, understandable and user-friendly tool. The aim of this paper is to propose and present just such a tool, called SIPRES. It is a novel technique that employs the key notions of the revised Simos' procedure (Figueira, Roy, 2002) and the ZAPROS method (Larichev, Moshkovich, 1995). On the one hand, it allows decision-makers to define their preferences in a simple and effortless way and provides a straightforward but effective method for analyzing the trade-offs between the alternatives using selected reference alternatives only (the ZAPROS-like approach). On the other hand, the revised Simos' procedure applied in the method allows determining the cardinal scores for the alternatives. The scoring system obtained this way makes it possible to conduct a sophisticated symmetric and asymmetric negotiation analysis.

This paper consists of an introduction, four sections and conclusions. In the second and in the third section the revised Simos' procedure and the ZAPROS method are presented as preliminaries to a new approach for scoring the negotiation template, namely the SIPRES algorithm, which is described in the fourth section. Finally, the fifth section provides an illustrative example concerning the European Union's multiannual financial framework negotiations.

2 The revised Simos' procedure

The revised Simos' procedure, introduced by Figueira and Roy (2002), is intended for the determination of the criteria weights in the ELECTRE type methods, but it can also be used to adapt or convert a scale of a given criterion into an interval or a ratio scale as well as to construct an interval or a ratio scale on any ordered set (cf. Roy, 1999).

The technique is based on a 'card-playing' procedure and consists of the following steps (Figueira, Roy, 2002):

1. We give the decision-maker a set of cards with the names of the elements (e.g. criteria) written on them; thus, we have *n* cards, where *n* is the number of elements (criteria). We also provide a set of blank cards of the same size (as many as the DM needs).
2. We ask the decision-maker to put the named cards in the ascending order, i.e. to sort the elements (criteria) from the least important (the worst) to the most important (the best) one. If, in the DM's opinion, some elements (criteria) have the same importance (and hence the same weight), the cards with their names should be placed together and held with a clip or a rubber band. As a result, we obtain a complete pre-order of the *n* elements (criteria) in which the least important (the worst) element (criterion) obtains rank 1 and the number of ranks is less than or equal to *n*.
3. We ask the decision-maker to consider whether the distances between the positions in the ranking are the same or not. In order to distinguish the importance of two successive elements (criteria) or subsets of equally important elements (criteria), we ask the DM to introduce blank cards between the subsequent cards according to the following rules:
   a) the greater the difference between the weights of the elements (criteria) or subsets of equally important elements (criteria), the greater the number of blank cards;
   b) no blank card means that the elements (criteria) do not have the same weight and the difference between the weights constitutes the unit (denoted by *u*) adopted for measuring the intervals between weights; *h* blank cards mean a difference of *h+1* units.
4. We ask the decision-maker to determine how many times the last-ranked element (criterion) is more important (better) than the first one; let *z* be the value of this ratio.
5. Let $e_r^{'}$ be the number of blank cards between the positions r and $r+1$. We calculate:

$$\begin{cases} e_r = 1 + e_r^{'} \qquad \forall r = 1,\dots,n^* - 1 \\ e = \sum_{r=1}^{n^*-1} e_r \\ u = \dfrac{z-1}{e} \end{cases}$$

retaining six decimal places for u. Subsequently, we determine the non-normalized weight $p(r)$ for each position in the ranking: $p(r) = 1 + u \cdot (e_0 + \ldots + e_{r-1})$, where $e_0 = 0$. We round these weights to two decimal places. If there are several elements (criteria) in the same position r, all of them obtain the same weight $p(r)$.

6. Let g_k be an element (criterion) in the position r, and p'_k – the non-normalized weight of this element (criterion), $p'_k = p(r)$. We calculate:

$$\begin{cases} P' = \sum_{k=1}^{n} p'_k \\ p^*_k = \dfrac{100 \cdot p'_k}{P'} \end{cases}$$

Subsequently, we determine p''_k by deleting some of the decimal digits from p^*_k. Let s be the number of decimal places taken into account. We compute:

$$\begin{cases} P'' = \sum_{k=1}^{n} p''_k \le 100 \\ \varepsilon = 100 - P'' \le 10^{-s} \cdot n \\ v = 10^{s} \cdot \varepsilon \end{cases}$$

Finally, we set $p_k = p''_k + 10^{-s}$ for v suitably selected elements (criteria) and $p_k = p''_k$ for the other $n - v$ elements (criteria). We obtain $\sum_{k=1}^{n} p_k = 100$, where p_k is the normalized weight of the element (criterion) g_k, with the required number of decimal places.

The choice of the v elements (criteria), whose weights will be rounded, is performed using the following algorithm:

1. For each element (criterion) g_k we determine the ratios:

$$d_k = \frac{10^{-s} - (p^*_k - p''_k)}{p^*_k}$$

$$d^*_k = \frac{(p^*_k - p''_k)}{p^*_k}$$

2. We create two lists, R and R^*:
   a) the R list, consisting of the pairs (k, d_k) sorted in the ascending order of d_k,
   b) the R^* list, consisting of the pairs (k, d^*_k) sorted in the descending order of d^*_k.

3. We set $M = \{k : d_k > d_k^*\}$, $|M| = m$.
4. We partition the set of n elements (criteria) into two subsets: F^+ and F^-, where $|F^+| = v$ and $|F^-| = n - v$, as follows:
   - if $m + v \leq n$, then F^- consists of the m elements (criteria) of M and the last $n - v - m$ elements (criteria) of R^* which are not in M; while F^+ consists of the first v elements (criteria) of R^* which are not in M;
   - if $m + v > n$, then F^+ consists of the $n - m$ elements (criteria) not belonging to M and the first $v + m - n$ elements (criteria) of R which are in M; while F^- consists of the last $n - v$ elements (criteria) of R which are in M.

3 The ZAPROS method

The ZAPROS method (Larichev, Moshkovich, 1995) is intended for decision-making problems in which it is required to order a fairly large number of alternatives. The set of the alternatives may change while the decision rules remain constant.

The technique is based on Verbal Decision Analysis (VDA). The term 'Verbal Decision Analysis' had not been introduced by Larichev and Moshkovich until 1997 (Larichev, Moshkovich, 1997), even though research within this approach had already started in the 1980s (see, e.g., Larichev, Moshkovich, 1988).

VDA is a framework for designing MCDA methods by using preferential information obtained from the decision makers in the ordinal form (for instance 'more preferable', 'less preferable' or 'equally preferable'). This type of judgments seems stable and reliable according to the results of psychological experiments. Moreover, the judgments are verified by testing their consistency (Ashikhmin, Furems, 2005; Moshkovich, Mechitov, 2013).

VDA is based on cognitive psychology, applied mathematics and computer science, and it was proposed for unstructured decision-making problems[2] which are problems with mostly qualitative parameters and no objective model for their aggregation. Examples of such tasks can be found in policy making and strategic

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[2] The general features of unstructured problems are as follows (Larichev, 2001; Moshkovich et al., 2005):
- they are unique in the sense that each problem is new to the decision-maker and has characteristics not previously experienced;
- the criteria in these problems are mostly qualitative in nature, most often formulated in a natural language;
- in many cases, the evaluations of alternatives according to the criteria may be obtained only from human beings (experts or decision-makers);
- the degrees of the criterion scales are defined verbally and represent subjective assessments by the decision-maker.

planning in different fields, as well as in personal decisions. For instance, the ZAPROS method (and its variations) has been used in R&D planning (see Larichev, Moshkovich, 1995 and 1997), applicant selection (see Moshkovich et al., 1998), job selection and pipeline selection (Moshkovich et al., 2005).

VDA takes into account peculiarities and constraints of the human information processing system. The key idea of the VDA approach is that there is a need for a decision aiding tools, which enable the decision maker to express his/her evaluations and preferences verbally, and this linguistic, non-numerical form should not be transformed into a quantitative one in any arbitrary way (Moshkovich, Mechitov, 2013). Techniques based on VDA do not use quantitative information on the importance of criteria, only verbal estimates, and no quantitative operations are performed on them. Hence, all operations are clear and understandable to decision-makers (Ashikhmin, Furems, 2005).

Table 1: VDA approach – summary

Verbal decision analysis
Application
Designed to elicit a sound preference relationship that can be applied to future cases; especially useful when a decision is made under new circumstances or in conditions of high ambiguity
Decision-making problem
More oriented to tasks with a fairly large number of alternatives, while the number of criteria is usually relatively small so as to reduce the number of comparisons required
Methodology
Bases its outranking on axiomatic relationships, to include direct assessment, dominance, transitivity and preferential independence Based on the same principles as MAUT but oriented toward using the verbal form of preference elicitation and toward evaluation of alternatives without resorting to numbers; as in MAUT, the idea is to construct universal decision rules in the criteria space and then use them on any set of actual alternatives
Decision-makers
Does not require any special knowledge of decision analysis on the part of the decision-makers

Source: Moshkovich et al. (2005).

In 1997 three methods were introduced as a VDA toolkit – one for each major type of decision-making problems, namely (Moshkovich, Mechitov, 2013):
- PARK (Berkeley et al., 1991) – for selecting the best alternative,
- ORCLASS (Larichev, Moshkovich, 1994) – for classifying alternatives,
- ZAPROS (Larichev, Moshkovich, 1995) – for ordering alternatives.

As regards ZAPROS, preference elicitation consists in comparisons of pairs of hypothetical alternatives (each with the best evaluations for all the criteria but one) differing in performance with respect to two criteria only. The results of these comparisons are transformed into the so-called Joint Ordinal Scale (JOS), which is subsequently used to compare actual decision-making alternatives (Ashikhmin, Furems, 2005).

The ZAPROS procedure consists of the following steps (Moshkovich et al., 2005):

1. We determine the evaluation scale for each criterion considered in the decision-making problem.
2. We compare pair-wise the hypothetical alternatives, each with the best possible values for all the criteria but one, using the ordinal scale (more preferable, less preferable, and equally preferable).
3. We construct the JOS, which is a complete rank order of the hypothetical alternatives with the best evaluations for all the criteria but one.
4. We compare pair-wise the actual decision-making alternatives using the JOS and construct a partial order on their set.

4 The SIPRES method

From the point of view of the negotiation analysis and evaluation of the negotiation template ZAPROS has a few advantages:

- it allows comparing complete packages (offers), which is a natural way of evaluating the concessions between the offers by the negotiators;
- it does not require evaluating the weights of negotiation issues separately, but derives them from package-to-package comparisons;
- it compares quasi-ideal packages, which are close to aspiration levels defined usually by the negotiators.

Unfortunately, it has also one serious disadvantage, namely a relatively low comparison power, which makes the occurrence of incomparability of alternatives (offers) almost unavoidable. Moreover, the outcome is represented on a graph showing the preference relations and ranking only which might be insufficient for the negotiators expecting numerical information on differences between the global attractiveness of the alternatives (offers).

Taking these drawbacks into account, a new approach called SIPRES is proposed. The acronym **SIPRES** stands for: **Si**mos' **p**rocedure for **Re**ference **S**ituations. It is based on two methods: revised Simos' procedure and ZAPROS, and aims at obtaining a complete ranking of the alternatives with scores measured on a cardinal scale.

Let $F = \{f_1, f_2, \ldots, f_n,\}$ be a finite set of n evaluation criteria (issues); X_k – a finite set of possible verbal values on the scale of criterion $k = 1,2,\ldots,n$, where $|X_k| = n_k$; $X = \prod_{k=1}^{n} X_k$ is the set of all possible vectors in the decision (negotiation) space of n criteria; and $A = \{a_1, a_2,\ldots, a_m\} \subseteq X$ is a subset of X describing the alternatives (offers) considered.

The SIPRES procedure consists of the following steps:

1. We determine the evaluation scale for each criterion considered in the negotiation problem.
2. We prepare a set of blank cards and a set of cards with hypothetical alternatives (each with the best resolution level for all the criteria but one) as well as the ideal and anti-ideal reference vectors (with the best and the worst evaluations for all the criteria, respectively) and rank them from the worst to the best one.
3. We introduce blank cards between two successive cards if necessary. The greater the difference between the evaluations of the alternatives, the greater the number of blank cards:
   a) no blank card means that the alternatives do not have the same evaluation and that the difference between the evaluations is equal to one unit u used for measuring the intervals between evaluations,
   b) one blank card means a difference of two units, two blank cards mean a difference of three units, etc.
4. We determine how many times the best alternative is better than the worst one in the ranking.
5. We process the information obtained as in the revised Simos' procedure in order to obtain the normalized scores for the elements compared, i.e. to form the Joint Cardinal Scale (JCS).
6. We substitute the resolution levels in each vector describing the alternative from the negotiation template by the corresponding scores from the JCS. For each alternative we define the distance from the ideal alternative using the formula:

$$L_i = \sum_{k=1}^{n} (p_k^{\max} - p_{ik})$$

   where p_{ik} is the score from the JCS substituting the assessment of alternative a_i according to criterion f_k and $p_k^{\max}$ is the score for the best possible assessment for a given criterion.
7. We construct the complete final ranking of the alternatives according to the distance values L_i in ascending order.

5 Illustrative example

The usefulness of the SIPRES method for the facilitation of the negotiation process, namely for building a negotiation offer scoring system, will be illustrated by an example which concerns the European Union's multiannual financial framework negotiations.

The multiannual financial framework (MFF) is a spending plan that translates the EU priorities into financial terms. It sets the limits for the general annual budgets of the EU ('ceilings') as it determines how much in total and how much for different broad policy areas ('headings') the EU may spend each year over a period of at least 5 years. The previous MFF period started in 2007 and ended in 2013; the current one covers the years from 2014 to 2020 (www 1; www 4). The MFF ensures that EU spending is predictable. Besides, it allows the EU to conduct common policies over a long enough period to make them work. This long-term vision is important for potential beneficiaries of EU financial support, co-financing authorities, as well as national treasuries (www 3). The MFF regulation is proposed by the European Commission. It is adopted by the Council in a unanimous vote and after having obtained the consent of the European Parliament (www 1).

The negotiations on the MFF are one of the key issues for the Member States since they determine the possibility of obtaining funds from the EU for at least 5 years. The history of the MFF negotiations demonstrates that this process is long and complicated. It consists of three stages carried out at different levels. The first stage, lasting 1-2 years on average, consists of the negotiations in the Council, during which the final outline of the MFF is determined. The second stage consists of the negotiations with the European Parliament. Stage three, which consists of the negotiations of dozens of acts that constitute the legal basis for the implementation of the policies and mobilization of the previously negotiated funds, is carried out in parallel to the first two stages and lasts 1-1.5 years (www 5). Hence, the MFF 2007-2013 negotiations, conducted after the Eastern enlargement, were launched in 2004 and concluded in 2007, and the MFF 2014-2020 negotiations, taking place in a difficult situation for the EU, both economically (recession, increasing unemployment, sovereign debt crisis) and politically (the rise of Euroscepticism, dominance of the national interests, Member States' unwillingness to contribute to the EU budget), began in 2011 and proceeded two and a half years (www 2; www 5).

Let us assume that in the European Union's multiannual financial framework negotiations, a Member State decides to formalize and evaluate the negotiation template to obtain the negotiation offer scoring system.

The following negotiation issues are discussed:

- f_1 – the size of the European budget,
- f_2 – the allocation of the resources under the EU budget,
- f_3 – the way of financing the expenditures.

The negotiation template is defined linguistically for all the issues considered by means of the following sets of the reference salient options:

Table 2: Negotiation template

Issues		Options
f_1	**Budget size**	**A1**. Increased
		A2. Unchanged
		A3. Decreased
f_2	**Allocation of the resources**	**B1**. Very favorable (fully consistent with the position of the Member State)
		B2. Favorable (highly consistent with the position of the Member State)
		B3. Neutral (partially consistent, partially inconsistent with the Member State's position)
		B4. Adverse (highly inconsistent with the position of the Member State)
		B5. Very adverse (fully inconsistent with the position of the Member State)
f_3	**Financing of expenditures**	**C1**. Favorable (consistent with the expectations)
		C2. Neutral
		C3. Adverse (inconsistent with the expectations)

Table 3 presents the ranking of cards with hypothetical alternatives (offers), determined by the Member State in accordance with steps 2 and 3 of the SIPRES algorithm. The ranking includes the offers with the best resolution level for all the criteria but one along with the ideal and anti-ideal alternatives. Additionally, in the cloud, the information required by step 4 of the algorithm is provided on how many times, in the Member State's opinion, the best alternative is better than the worst one.

Table 3: Member State's preferences based on the card play procedure

A3	**B5**	**C3**
Blank card		
Blank card		
Blank card		
Blank card		
Blank card		
A1	**B5**	**C1**
A3	**B1**	**C1**
A1	**B4**	**C1**
Blank card		
A1	**B3**	**C1**
Blank card		
A1	**B1**	**C3**
A2	**B1**	**C1**
Blank card		
A1	**B2**	**C1**
A1	**B1**	**C2**
A1	**B1**	**C1**

According to the Member State
[A1, B1, C1]
is **12 times better**
than **[A3, B5, C3]**.

Following step 5 of our algorithm, the information on Member State's preferences is processed as described in the revised Simos' procedure to obtain the normalized evaluations for the elements compared, i.e. to form the Joint Cardinal Scale (JCS). The calculations are shown in the tables below.

Table 4: Determining the non-normalized evaluations of the hypothetical alternatives (z = 12)

Position r	Alternatives in the position r			Number of blank cards between the positions r and r + 1	e_r	Non-normalized evaluations p(r)
	f_1	f_2	f_3			
1	A3	B5	C3	5	6	1.00
2	A1	B5	C1	0	1	4.88
3	A3	B1	C1	0	1	5.53
4	A1	B4	C1	1	2	6.18
5	A1	B3	C1	1	2	7.47
6	A1	B1	C3	0	1	8.76
7	A2	B1	C1	1	2	9.41
8	A1	B2	C1	0	1	10.71
9	A1	B1	C2	0	1	11.35
10	A1	B1	C1	…	…	12.00
Sum				**8**	**17**	**77.29**

Table 5: Determining the normalized evaluations of the hypothetical alternatives (s = 2, z = 12)

Position r	Alternatives in the position r			p_k^*	$p_k^{''}$	d_k	d_k^*	Set M	p_k
	f_1	f_2	f_3						
1	A3	B5	C3	1.293828	1.29	0.004770	0.002959	(M)	1.29
2	A1	B5	C1	6.313883	6.31	0.000969	0.000615	(M)	6.31
3	A3	B1	C1	7.154871	7.15	0.000717	0.000681	(M)	7.15
4	A1	B4	C1	7.995860	7.99	0.000518	0.000733		8.00
5	A1	B3	C1	9.664898	9.66	0.000528	0.000507	(M)	9.66
6	A1	B1	C3	11.333937	11.33	0.000535	0.000347	(M)	11.33
7	A2	B1	C1	12.174926	12.17	0.000417	0.000405	(M)	12.18
8	A1	B2	C1	13.856903	13.85	0.000224	0.000498		13.86
9	A1	B1	C2	14.684953	14.68	0.000344	0.000337	(M)	14.69
10	A1	B1	C1	15.525941	15.52	0.000261	0.000383		15.53
Sum				**100**	**99.95**				**100**

Table 6: R and R^* lists (s = 2, v = 5, m = 7, n = 10)

List R					List R^*				
Position r	Alternatives			d_k	Position r	Alternatives			d_k^*
	f_1	f_2	f_3			f_1	f_2	f_3	
8	A1	B2	C1	0.000224	**1**	A3	B5	C3	0.002959
10	A1	B1	C1	0.000261	**4**	A1	B4	C1	0.000733
9	A1	B1	C2	0.000344	**3**	A3	B1	C1	0.000681
7	A2	B1	C1	0.000417	**2**	A1	B5	C1	0.000615
4	A1	B4	C1	0.000518	**5**	A1	B3	C1	0.000507
5	A1	B3	C1	0.000528	**8**	A1	B2	C1	0.000498
6	A1	B1	C3	0.000535	**7**	A2	B1	C1	0.000405
3	A3	B1	C1	0.000717	**10**	A1	B1	C1	0.000383
2	A1	B5	C1	0.000969	**6**	A1	B1	C3	0.000347
1	A3	B5	C3	0.004770	**9**	A1	B1	C2	0.000337
F^+ = {4, 8, 10, 9, 7}; F^- = {1, 2, 3, 6, 5}									

Tables 7 and 8 present the normalized scores for the hypothetical reference alternatives and the Joint Cardinal Scale respectively. The normalized scores reflect the scale of concessions required, when the ideal option is replaced by the option under consideration.

Table 7: Normalized scores of the hypothetical alternatives

Alternatives			p_k
f_1	f_2	f_3	
A3	B5	C3	1.29
A1	**B5**	C1	6.31
A3	B1	C1	7.15
A1	**B4**	C1	8.00
A1	**B3**	C1	9.66
A1	B1	**C3**	11.33
A2	B1	C1	12.18
A1	**B2**	C1	13.86
A1	B1	**C2**	14.69
A1	**B1**	**C1**	15.53

Table 8: Joint Cardinal Scale

JCS	
Resolution level	**Score**
B5	6.31
A3	7.15
B4	8.00
B3	9.66
C3	11.33
A2	12.18
B2	13.86
C2	14.69
A1	15.53
B1	15.53
C1	15.53

Following step 6 of the SIPRES algorithm we substitute the resolution levels in each vector describing the alternative from the negotiation template by the corresponding scores from the JCS. For each alternative we define the distance from the ideal alternative and on this basis we build the ranking of the alternatives. The distances to the ideal alternative for each of the 45 packages that can be built within the negotiation template as well as their ranks are given in Table 9.

Table 9: Packages, their distances to the ideal alternative and ranks

Criterion value			Score			Distance L_i	Rank
f_1	f_2	f_3	p_{i1}	p_{i2}	p_{i3}		
A1	B1	C1	15.53	15.53	15.53	0.00	1
A1	B1	C2	15.53	15.53	14.69	0.84	2
A1	B2	C1	15.53	13.86	15.53	1.67	3
A1	B2	C2	15.53	13.86	14.69	2.51	4
A2	B1	C1	12.18	15.53	15.53	3.35	5
A2	B1	C2	12.18	15.53	14.69	4.19	6
A1	B1	C3	15.53	15.53	11.33	4.20	7
A2	B2	C1	12.18	13.86	15.53	5.02	8
A2	B2	C2	12.18	13.86	14.69	5.86	9
A1	B2	C3	15.53	13.86	11.33	5.87	10.5
A1	B3	C1	15.53	9.66	15.53	5.87	
A1	B3	C2	15.53	9.66	14.69	6.71	12
A1	B4	C1	15.53	8.00	15.53	7.53	13
A2	B1	C3	12.18	15.53	11.33	7.55	14
A1	B4	C2	15.53	8.00	14.69	8.37	15
A3	B1	C1	7.15	15.53	15.53	8.38	16
A1	B5	C1	15.53	6.31	15.53	9.22	18.5
A2	B2	C3	12.18	13.86	11.33	9.22	
A2	B3	C1	12.18	9.66	15.53	9.22	
A3	B1	C2	7.15	15.53	14.69	9.22	
A3	B2	C1	7.15	13.86	15.53	10.05	21
A1	B5	C2	15.53	6.31	14.69	10.06	22.5
A2	B3	C2	12.18	9.66	14.69	10.06	
A1	B3	C3	15.53	9.66	11.33	10.07	24
A2	B4	C1	12.18	8.00	15.53	10.88	25
A3	B2	C2	7.15	13.86	14.69	10.89	26
A2	B4	C2	12.18	8.00	14.69	11.72	27
A1	B4	C3	15.53	8.00	11.33	11.73	28
A2	B5	C1	12.18	6.31	15.53	12.57	29
A3	B1	C3	7.15	15.53	11.33	12.58	30
A2	B5	C2	12.18	6.31	14.69	13.41	31
A1	B5	C3	15.53	6.31	11.33	13.42	32.5
A2	B3	C3	12.18	9.66	11.33	13.42	
A3	B3	C1	7.15	9.66	15.53	14.25	34.5
A3	B2	C3	7.15	13.86	11.33	14.25	
A2	B4	C3	12.18	8.00	11.33	15.08	36
A3	B3	C2	7.15	9.66	14.69	15.09	37
A3	B4	C1	7.15	8.00	15.53	15.91	38
A3	B4	C2	7.15	8.00	14.69	16.75	39
A2	B5	C3	12.18	6.31	11.33	16.77	40
A3	B5	C1	7.15	6.31	15.53	17.60	41
A3	B5	C2	7.15	6.31	14.69	18.44	42
A3	B3	C3	7.15	9.66	11.33	18.45	43
A3	B4	C3	7.15	8.00	11.33	20.11	44
A3	B5	C3	7.15	6.31	11.33	21.80	45
f_1	f_2	f_3	p_{i1}	p_{i2}	p_{i3}	Distance L_i	Rank
Criterion value			Score				

6 Conclusions

The SIPRES method proposed in this paper is an uncomplicated and functional technique which should improve the decision-making process. It requires the negotiators to supply the basic preferential information only – they need to evaluate trade-offs only, which seems natural for them since this is similar to the actual decision making analysis conducted in a real-life negotiations. Moreover, when defining preferences, the negotiators use an intuitively interpreted card tool. As a result, a cardinal negotiation offer scoring system is built, in which no two alternatives are incomparable.

Additionally, it should be noted that the SIPRES method can be applied not only in negotiation support to build a negotiation offer scoring system but also in other multi-criteria decision aiding contexts, such as policy-making, strategic planning, transportation or environmental problems to order the alternatives or to select the best one.

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