14

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PROCEDURE

FOR THE SELECTION OF A SMART CONTRACTING SYSTEM IN THE LEGAL FIELD

PROCEDIMIENTO PARA LA SELECCIÓN DE UN SISTEMA DE CONTRATACIÓN INTELIGENTE EN EL ÁMBITO JURÍDICO

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ABSTRACT

Blockchain technology has put in the hands of humanity the solution to many practical problems that are present today in various organizations. Smart contracts are part of the improvements that were introduced from the use of this technology and were widely accepted by users in general. Various applications are included in the development of this type of platform, which has reached the legal field as a solution to the current problems of Contract Law. The selection of the best alternative, when hiring its implementation, leads to not making optimal use of resources during the process. That is why the main objective of the research was focused on designing and implementing a procedure, in the form of an exercise, for the selection of a smart contracting system in the legal field. In its fulfillment, the authors had the support of a heterogeneous group of experts in the field who determined the factors for their selection and their respective weight through the Kendall concordance method. Subsequently, the use of these factors in the VIKOR (VIseKriterijumska Optimizacija I Kompromiso Resenje) method made it possible to determine the best alternative to hire.

Keywords: Smart Contracting, Contract Law, Kendall, VIKOR.

RESUMEN

La tecnología Blockchain ha puesto en manos de la humanidad la solución a muchos problemas prácticos que se presentan hoy en día en diversas organizaciones. Los contratos inteligentes son parte de las mejoras que se introdujeron a partir del uso de esta tecnología y fueron ampliamente aceptados por los usuarios en general. Diversas aplicaciones se incluyen en el desarrollo de este tipo de plataformas, que han llegado al ámbito jurídico como solución a los problemas actuales del Derecho Contractual. La selección de la mejor alternativa, a la hora de contratar su implantación, lleva a no hacer un uso óptimo de los recursos durante el proceso. Es por ello que el objetivo principal de la investigación se centró en diseñar e implementar un procedimiento, en forma de ejercicio, para la selección de un sistema de contratación inteligente en el ámbito jurídico. En su cumplimiento, los autores contaron con el apoyo de un grupo heterogéneo de expertos en la materia que determinaron los factores para su selección y su respectivo peso a través del método de concordancia de Kendall. Posteriormente, la utilización de estos factores en el método VIKOR (VIseKriterijumska Optimizacija I Kompromiso Resenje) permitió determinar la mejor alternativa de contratación.

Palabras clave: Contratación inteligente, Derecho contractual, Kendall, VIKOR.

INTRODUCTION

As stated by (Rohr, 2019), a "Smart Contract" is an unfortunate name for something that isn't necessarily smart, or necessarily a contract. There is no official or universally accepted definition of the term, but everyone agrees that there is "code" involved and that this code will be executed automatically when certain conditions occur. These types of contracts are most commonly identified with the Ethereum blockchain, a public blockchain that supports a turn-complete coding language, Solidity.

The term "smart contract" is also used in a general sense to refer to a computer protocol (code) that is stored on a blockchain (or distributed ledger) and that nodes on the blockchain will automatically execute upon the occurrence of specified conditions. Although they may be, smart contracts are not necessarily legal contracts. Due to the immutability of the blockchain, smart contracts take on a life of their own: they cannot be unilaterally stopped, delayed, or modified without a fundamental change to the chain protocol in which the code resides or an "out" that was incorporated. to the code from the beginning (Rohr, 2019).

For (Djurovic & Janssen, 2018), the main threads of discussion regarding smart contracts in legal academia seem to be whether or not they are contracts in the legal sense, whether they are a disruptive innovation in the legal system, and their potential benefits and threats. That said, the legal provisions on the aforementioned remain scant compared to the impact that smart contracts could have in the future even though the legal literature on the aforementioned is growing exponentially. There is a multitude of documents on how smart contracts work or what they are, especially on forums dedicated to Blockchain or Bitcoin. However, they do not normally offer an in-depth analysis of the legal issues

Smart contracts raise interesting questions about their legal nature. Existing smart contracts are often just said to not be particularly smart or even legally binding contracts strictly speaking. Any discussion of smart contracts and their impact on current contract law must begin with identifying the definition of the concept to prevent it from becoming a mere buzzword. So what is a smart contract? The question, if you ironically consider all the praise from proponents of Blockchain technologies about ending the ambiguity and confusion caused by natural language, is more contentious than you might expect. (Djurovic & Janssen, 2018).

According to (DiMatteo & Poncibó, 2018) , optimistic forecasts about the potential for smart contracts to be self-executing, freeing business transactions from the transaction costs of court and arbitral proceedings, and the formal application of contract law, raise other questions. Are smart contracts really smart or are they just simple in what they can do? Smart contracts have already proven themselves in financial transactions, but can they be made efficient in complex contract scenarios? Are smart contracts really contracts or do they just resemble the internet in serving as a means of communication and not self-executing substantive private law?

The same author argues that it is the area of self-enforcement and solutions where the vision of smart contracts meets the reality of contract law and business law. These types of contracts must be drafted by lawyers, focused on the interests of the client and not on technological prowess. For lawyers to better serve their clients, they would have to learn to write computable code, while judges would have to learn code to interpret the contract or rely on expert interpretation. Assuming that there is only one interpretation of a computer code, is the question of the correct or reasonable legal interpretation of contracts miraculously resolved? In a nutshell, is this a steep too far in the advancement of self-executing smart contracts?

Unfortunately, these questions remain unanswered, as the courts have not yet addressed an issue about the readability of the code in the smart contract and its enforcement is greatly reduced. One strategy users can employ to address these obscurities is to carefully word the smart contract to address ambiguities ***ex ante***. While this careful wording will mitigate considerable uncertainties between the contracting parties, it is difficult for the parties to reduce their entire agreement to fully defined terms ***ex ante*** of the mechanism", making the cost of non-compliance so high that it serves as a deterrent. (Temte, 2019).

On the other hand, argues (Temte, 2019), smart contracts have numerous advantages: streamlined business operations, increased speed and efficiency in business transactions, and low-cost contract enforcement. Smart contracts are advantageous because they bind the parties to their original agreements. These types of contracts make the risk of default more costly for the breaching party, which almost eliminates the possibility of default. If the cost of litigation outweighs the probable value of the contract, ***ex ante*** performance is favorable. To go back to the vending machine example, "the amount in the box must be less than the cost of the violation.

When referring to its disadvantages, most of which focus on the lack of control and regulation, often in the form of comprehensibility, code rigidity, and decentralization rigidity. Commenters see understandability as a common issue, as smart contracts are often written in code rather

than a common language. Consequently, the average person cannot interpret exactly what the contract says. Rather, the contracting parties are at the mercy of the coded language and the programmers who wrote it. An important question arises in the codified language appearing in litigation: whether a court can enforce the codified language if self-enforcement ends in litigation (Temte, 2019).

Taking into account the above, there are not a few pioneers in the implementation of these systems at a global level for legal purposes. (Ante, 2021; Cannarsa, 2018). Despite its disadvantages and its scarcity in the regulatory framework, it is evident that this type of system is the solution to many problems that Contract Law faces today. (Drummer & Neumann, 2020; Templin, 2019). Knowing what criteria must be taken into account to select one of them at the time of contracting and through what methods to do it, is of great importance for legal organizations that intend to venture into this subject.

When considering this problem, the main objective of this research is to design and apply a procedure for the selection of an intelligent contracting system in the legal field. For its fulfillment, the following specific objectives are proposed:

1. Determination of the factors to be evaluated for the selection of the best alternative in the implementation of these systems with the support of the company's senior management.
2. Calculation of the weights associated with each process using the Kendall method.
3. Selection of the best alternative for the implementation of the smart contracting system through the use of the VIKOR method (VIseKriterijumska Optimizacija I Kompromiso Resenje).

To carry out the research, a section dedicated to the presentation of materials and methods and another referring to the analysis of their application and discussion was structured. Later, the content of the work is summarized in the form of conclusions and is matched with a body of bibliography.

MATERIALS AND METHODS

Kendall's concordance coefficient

With the result of the evaluation of the experts, the degree of concordance or agreement between them must be determined, using the Kendall concordance coefficient, which is represented by the following expression (Franceschini & Maisano, 2021; Yang et al, 2020):

$$W = \frac{12\sum(\Delta^2)}{M^2(K^3 - K)} \quad (1)$$

Where: M: Number of experts; k: number of attributes or criteria to evaluate:

: Deviation of the mean value of the ***q*** judgments issued can be determined through the following expression:

$$\Delta = \sum_{i=1}^{m}\left[a_{ij} - T\right] \quad (2)$$

a_{ij}: importance judgment of attribute ***i*** given by expert ***j***;

T: comparison factor (mean value of the ranges) and is determined by the following formula

$$T = \frac{M(k+1)}{2} = \frac{\sum_{j=1}^{k}\sum_{J=1}^{k} a_{ij}}{k} \quad (3)$$

The value of Kendall's concordance coefficient (W) must range between 0 and 1. W=1 means a total concordance of agreements, and the value W=0, represents a total disagreement between the experts. A value of W=0.5 indicates a balance between the judges and those less than 0.5 are considered as a tendency to disagreement among the experts. Obviously, the tendency to 1 is the desired, although new rounds can be carried out if the first does not reach significance in the concordance. (Melinosky et al, 2021; Simpson et al, 2020; Romero et al, 2022).

VIKOR

The VIKOR is a multi-criteria decision method (MCDM) to solve problems and obtain the best compromise solution. This method focuses on ranking and selecting from a set of alternatives in the presence of conflicting criteria. The main objective of the VIKOR method is to choose a solution that is closest to the ideal level in each criterion so that the alternatives are based on the particular measure of "closeness" to the "ideal" solution. (Sałabun et al, 2020; Gupta, 2018).

Step 1: Normalize the decision matrix.

The following formula can be used to normalize:

$$f_{ij}(\mathrm{x}) = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \; i = 1, \ldots, m \; ; j = 1, \ldots, n \quad (4)$$

Step 2: Determine the best and worst contributions for each criterion. $f_i^* f_i^-$

The best and worst contribution can be determined by the following formula:

If the criterion is positive, then:

$$f_j^* = Max_i f_{ij}\,, f_j^- = Min_i f_{ij}\,;\; j = 1,2,\dots,n \quad (5)$$

If the criterion is negative, then:

$$f_j^* = Min_i f_{ij}\,, f_j^- = Max_i f_{ij}\,;\; j = 1,2,\dots,n \quad (6)$$

The positive ideal solution (and the negative ideal solution f^*, f^-) can be expressed as follows:

$$f^* = \{f_1^*, f_2^*, f_3^*, \dots, f_n^*\} \quad (7)$$

$$f^- = \{f_1^-, f_2^-, f_3^-, \dots, f_n^-\} \quad (8)$$

Step 3: Calculate S_i and R_i values

The values representing group utility and individual regret, respectively, can be calculated using the following formulas: S_i and R_i

$$S_i = \sum_{j=1}^{n} w_j \frac{(f_j^* - f_{ij})}{(f_j^* - f_j^-)} \quad (9)$$

$$R_i = Max_j \left[w_j \frac{(f_j^* - f_{ij})}{(f_j^* - f_j^-)} \right] \quad (10)$$

Where w_j denotes the weight of the criteria.

Step 4: Calculate the value of Q_i

The value that represents the VIKOR index for each alternative can be calculated using the following formula: Q_i

$$Q_i = \gamma \frac{(S_i - S^*)}{(S^- - S^*)} + (1-\gamma) \frac{(R_i - R^*)}{(R^- - R^*)} \quad (11)$$

Where

$$S^* = Min_i\{S_i\}\,;\; S^- = Max_i\{S_i\}\,;\; R^* = Min_i\{R_i\}\,;\; R^- = Max_i\{R_i\} \quad (12)$$

And γ is the maximum utility of the group.

Step 5: Rank the alternatives, ranking by the values S, R and Q.

The alternatives are classified by sorting the values S, R and Q in decreasing order so that the best ranking is assigned to the alternative with the smallest VIKOR value. The results are three ranking lists (Zeng et al, 2019; Hu et al, 2020; von Feigenblatt et al, 2021).

Step 6: Propose a compromise solution.

The alternative to select is the best classified by the Q measure (minimum) if the following two conditions are met:

Condition 1. Acceptable advantage: where is the alternative with the first position and is the alternative with the second position in the ranking list by Q. m is the number of alternatives. $Q(A^{(2)}) - Q(A^{(1)}) \geq 1/(m-1)\; A^{(1)}A^{(2)}$.

Condition 2. Acceptable Stability in Decision Making: The alternative must also be the highest ranked by and/or .

If one of the conditions is not met, a set of compromise solutions is proposed, consisting of:

Solution 1. Alternatives if Condition 1 is not met; the alternative is determined by M maximum (the positions of these alternatives are $A^{(1)}, A^{(2)}, \dots, A^{(M)}\; A^{(M)}Q(A^{(M)}) - Q(A^{(1)}) < \frac{1}{m-1}$ ''in proximity'').

Solution 2. Alternatives $A^{(1)}$ and $A^{(2)}$ if only condition 2 is not met.

Solution 3. The alternative with the minimum value of Q will be selected as the best alternative if both conditions are met.

RESULTS AND DISCUSSION

Procedure for the selection of smart contracting systems in the legal field

The objective of this procedure is to show a detailed guide for the selection of these systems as part of decision-making support by the senior management of the interested organizations. For them, it is structured in 5 logical steps that are easy to understand and supported by expert methods such as Kendall and MCDM tools such as VIKOR. The steps are outlined below in the schematic and verbal form:

Fig 1: Procedure for the selection of smart contracting systems in the legal field. Source: own elaboration.

Step 1. Determination of the group of experts

To carry out this step, the selection of experts can use both statistical and empirical methods. It is recommended that the group of experts is given a heterogeneous composition to seek greater diversity in opinions and

considerations. Several people in the range of 7 to 20 should also be taken into account to make the exercise more feasible.

Step 2. Selection of factors for comparison

Through techniques such as interviews, brainstorming, or Delphi, the criteria of the experts can be obtained regarding the factors that can influence the selection of alternatives of this type. In the case of a considerable number of factors, a weight assignment technique such as the AHP (Analytic Hierarchy Process) of Saaty or entropy chooses the ones with the highest weights for the researcher's consideration.

Step 3. Decantation of the factors and determination of the associated weight

For this step, the use of the Kendall Concordance method is recommended. The weighting by the experts will allow the less relevant factors to be chosen by using the Comparison Factor used as an asymptote before the sums of the points achieved by each factor. Another aspect to take into account is the concordance factor detailed in the previous section 2.1 and the weight of each criterion that will serve as the basis for carrying out the next step.

Step 4. Comparison of alternatives according to factor data

The use of the VIKOR multicriteria method is recommended for this type of task where factors and alternatives intervene. For its application, the information regarding each criterion for each alternative must be collected for subsequent comparison through its steps as shown in section 2.2.

Step 5. Selection of alternatives

For the selection of alternatives, proceed according to compliance with the conditions set forth for the previous method in section 2.2. For a better understanding of those involved in the process, the results of the criteria for the proposals that are selected must be detailed and, if necessary, a diagram or representation of the planning of the resources in their implementation over time must be made.

Application of the procedure for the selection of smart contracting systems in the legal field

Step 1 and Step 2. Determination of the group of experts and selection of the factors for comparison

For the development of the exercise, the experience of nine experts in the implementation of smart contracting systems associated with the legal field was taken into account. The group was made up of three researchers, two teachers, two Law School students, and two businessmen related to the subject of study. Through brainstorming, the group of experts determined the most recurrent factors that had to be taken into account for the implementation of this type of system. The selected factors were weighted using the Kendal concordance method as shown in Table 1.

Step 3. Decantation of the factors and determination of the associated weight

Table 1. Weightings of the experts for the selection of the criteria to be measured. Source: own elaboration

Criteria	1	2	3	4	5	6	7	8	9
Implantation time	1	1	3	3	2	3	2	3	4
Implementation costs	6	6	7	8	6	4	6	7	7
Costs for upgrades	7	7	6	5	5	8	5	6	6
Number of maintenance per year	2	3	2	2	3	2	3	2	2
Consulting Hours	8	5	4	6	7	6	7	4	5
Contract execution time	3	2	1	1	1	1	1	1	3
Number of contracts with other organizations	5	8	8	7	8	7	8	8	8
Assessment of the quality of service in other organizations	4	4	5	4	4	5	4	5	1

With the result of the previous weightings, the main elements were calculated to determine the calculation of W and the comparison factor. The results are shown in table 2 below:

Table 2. Calculation of the concordance coefficient (w) and the comparison factor (T). Source: own elaboration

	ΣA_{ij}	We	Δi	Δi2
Calculation of the concordance coefficient (w) and the comparison factor (T).	22	0.0679	-18.5	342.25
	57	0.1759	16.5	272.25
	55	0.1698	14.5	210.25
	21	0.0648	-19.5	380.25
	52	0.1605	11.5	132.25
	14	0.0432	-26.5	702.25
	67	0.2068	26.5	702.25
	36	0.1111	-4.5	20.25
$\sum \sum A_j$	324	1	0	2762
T=	40.5			
K=	8			
W=	0.811875367			

It was observed in the application of the method that a concordance was obtained among the experts higher than 0.81, which shows that the procedure can be validated if the analysis of figure 1 is attended, where a cut is made with the value of the comparison factor (T). Table 3 shows the factors with the best results that were chosen for the selection of the smart contracting system and their associated weight.

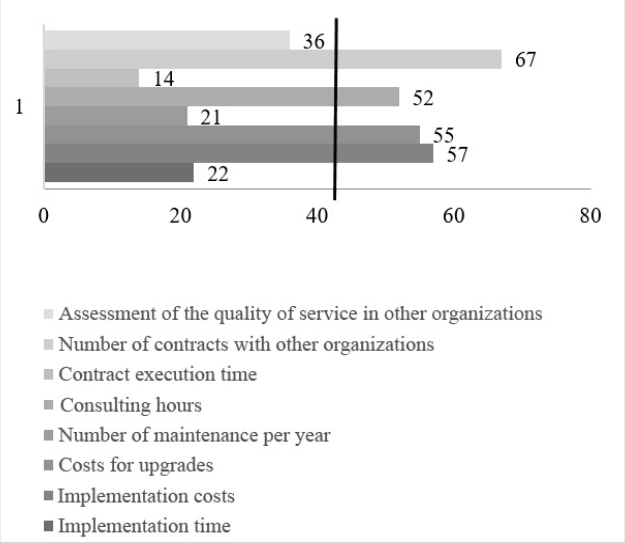

Fig 2: Selection of the factors to determine the best alternative using the comparison factor (T). Source: own elaboration

Table 3. Selected criteria and their associated weight. Source: own elaboration

K	We
Implementation costs	0.1759259
Costs for upgrades	0.1697531
Consulting Hours	0.1604938
Number of contracts with other organizations	0.2067901

Step 4. Comparison of alternatives based on factor data

When the selection factors were determined, the VIKOR method was applied, in which a total of 7 alternatives were evaluated for comparison. The data referring to the proposals of the organizations in charge of carrying out the implementation are shown in table 4. For the calculation, it was necessary to normalize the data of each alternative, Table 5, with which the utility of the group (S) and individual regret (R), Table 6, was determined. Once these steps were carried out, the VIKOR coefficient (Q) was determined and a ranking was established with the values of S, R, and Q to determine the best alternative. Table 7.

Table 4. Weightings of the experts for the choice of the criteria to be measured. Source: own elaboration

Alternatives/Criteria	C1	C2	C3	C4
P1	6800	1200	38	5
P2	4800	1300	42	6
P3	5300	1400	30	7
P4	4900	1300	36	4
P5	6200	1300	40	7
P6	6000	1100	44	3
P7	5500	1400	32	5
	6800	1400	30	3
	4800	1100	44	7

Table 5: Normalized decision matrix. Source: own elaboration

Alternatives/Criteria	C1	C2	C3	C4
P1	0.538	0.412	0.454	0.378
P2	0.380	0.447	0.502	0.454
P3	0.419	0.481	0.358	0.529
P4	0.388	0.447	0.430	0.302
P5	0.490	0.447	0.478	0.529
P6	0.475	0.378	0.526	0.227
P7	0.435	0.481	0.382	0.378

Table 6: Calculation of the utility of the group (S) and the own individual regret (R). Source: own elaboration

Alternatives/Criteria	R	yes
P1	0.113169	0.308275
P2	0.175926	0.525169
P3	0.206790	0.338735
P4	0.167130	0.344195
P5	0.206790	0.430791
P6	0.169753	0.400617
P7	0.114352	0.240675
P7= 0.0063187		0.0126374

Table 7: Ranking of alternatives with the values of S, R, and Q. Source: Own elaboration

Alternatives	R value	Rank in R	S value	Rank in S	Q value
P1	0.2376143	2	0	1	0.1188071
P2	1	7	0.6703297	5	0.8351648
P3	0.3446815	3	1	7	0.6723408
P4	0.3638735	4	0.5763736	3	0.4701236
P5	0.6682595	6	1	6	0.8341298
P6	0.5621997	5	0.6043956	4	0.5832977
P7	0	1	0.0126374	2	0.0063187

Step 5. Selection of alternatives

As final results, it was obtained that alternative P7 managed to meet the conditions of the method set out in section 2.2 with respect to the others. Figure 2. This alternative has a cost of 5500.00 USD (United States Dollar) for its implementation and the costs associated with maintenance amount to 1400.00 USD. In turn, he presented 44 hours of advice to support the learning process and presented 5 employment contracts with other homologous organizations.

Figura. 3: Ranking of the alternatives according to the conditions of the VIKOR method. Source: own elaboration.

CONCLUSIONS

In the development of the research, the identification of factors for the selection of alternatives was achieved with the help of the group of experts through brainstorming. The most representative criteria were taken as the basis for the application of the Kendall concordance method with the weightings of said experts, which allowed determining through the comparison of the comparison with the Compression Factor that the attributes implantation costs, costs per updates, consulting hours and number of contracts with other organizations were the most relevant for the experts.

For the application of the VIKOR method, the weights of the previously chosen factors were taken into consideration and the information corresponding to each of them was added by alternative. The results showed that the alternative with the lowest Q was number 7 and its data was presented. Although the investigation turned out to be an exercise, it leaves a guideline to follow for the selection of this type of system that, without a doubt, is projected as the solution to various legal problems of today.

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