

Regret Model for Arbitration: Predicting the Outcome

Abdulla Galadari and Hamad Al Hammadi

Abstract—Going through arbitration has many costs, both tangible and intangible. Going to arbitration may also result in the severance of a mutual relationship between a contractor and a client. It may result that the contractor would lose potential future profits by being barred from participating in future projects by the client. Therefore, it carries lots of risks associated with arbitration. Hence, even if the contractor is certain to win an arbitration case, the losses may outweigh the gains, resulting in regretting such a decision. This paper illustrates a mathematical multivariate matrix to determine the best decision to be taken considering a regret theory approach. A challenge for corruption in the decision-making process for arbitration is also highlighted based on a corrupt system of rewards within the organization for the pursuit of claims. Using the regret model reduces or eliminates possible decisions borne by a corrupt system. An example is provided to illustrate the difference between a typical decision theory approach and regret theory.

Index Terms—Arbitration, Construction contracts, Decision theory, Dispute, Regret modelling, Risk, Settlement.

I. INTRODUCTION

Dispute is a natural phenomenon. When two waves cross each other, interference occurs. Within the home, spouses may have disputes, and so do families. There are marital disputes, social disputes, political disputes, financial disputes, job disputes, construction disputes, etc. Humanity has established various methods to resolve disputes. However, each method may carry its own consequences. This paper illustrates a mathematical model proposed for arbitration using a regret theory approach.

Understanding regret theory is very simple. If the chance for rain is 50%, then a person has a choice of taking an umbrella or not. According to traditional decision-theory, since the chance for rain is exactly equal, then it does not really matter whether the person chooses to take an umbrella or not. However, this does not necessarily reflect realistic decision-making. There are four different scenarios that may arise in these events. Two of those scenarios are positive, in which the person does not take an umbrella and it does not rain or that the person takes an umbrella and it does rain. Those two scenarios have positive outcomes, because the choices made were accurate. However, due to uncertainty, the person cannot truly predict the outcome. Hence, just as there is a 50% chance of a positive outcome, there is also equally a 50% chance of a negative outcome. The two

scenarios with a negative outcome causes regret for the wrong choice made. The person may choose to take the umbrella, but it does not rain, causing the person to regret his choice. On the other hand, the person may choose not to take an umbrella and it does rain, which also causes regret. However, which wrong decision would the person regret more? Would he regret more the decision of taking an umbrella and it does not rain, or will he regret more the decision of not taking an umbrella, and he gets soaked wet in the rain? Although the chances of the outcomes are equal, the person will regret one of those outcomes more than another. Therefore, it does matter which choice the person makes even though the chances are equal, due to regret. Since arbitration may cause uncertain consequences on how both parties react to the procedure, then it is evident that a regret model for better decision-making.

In Jungian psychology, there are two modes of reactions that are manifested by individuals, depending on their personality, the logical thinking and the feeling [1]. As organizations consist of individuals, then organizational behaviour depends on the decision-makers [2]. Some decision-makers may be of the logical thinking type, where they would easily criticize others, and easily take in criticism, as long as the facts are logical. On the other hand, some decision-makers are the feeling type, giving more weight on how they feel about the subject matter more than the hard logical facts. Such individuals are not very critical of others nor do they easily accept criticism.

Decision-making is also dependent on rewards and penalties. If the decision-maker is rewarded for making a certain decision, then through natural cognitive behaviour, the person would make such decisions, even if it were imperatively wrong. The model proposed is, therefore, found to be important to reduce or eliminate corrupt decisions, whether intended or unintended.

The method of resolving conflicts and disputes may have differing consequences. If employees have a dispute with their employers, even if it were for a rightful reason, the consequences may be dire. Similarly in the construction industry, the method of resolving conflicts is also very important, as the consequences may be of great.

Going to arbitration to resolve construction disputes may not be an easy thing to do, because the consequences may be dire. A contractor's reputation may be affected by the arbitration case. Even if the contractor is certain to win an arbitration case, it may lose any potential future projects with the same client or even others in the market. Therefore, the long-term losses to the contractor may outweigh its immediate benefit in going through the arbitration. Therefore, going through arbitration may be a reason of regret.

This paper develops examples based on a proposed stochastic mathematical model as in [3] that would allow parties of the arbitration to predict the future outcome of the

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case and evaluate it within a regret theory approach to determine whether or not going through an arbitration process proves to be beneficial in the long-term relations within the market. This paper tests the model proposed against few scenarios to illustrate its applicability. As a result, it does not necessarily predict the outcome of the arbitration, whether it is in favour to the party or against it. The party proceeding to arbitration may have the full rights for doing so and may even have a very high chance of winning. However, the model illustrated in this paper attempts to predict whether the choice of going through arbitration or not may be regretted.

II. REGRET THEORY

Sometimes people do not take a decision because it is the best, but because it provides the optimum benefit with the least regret, if the outcome was negative. Hence, such a realistic approach is also necessary when evaluating whether or not to go through arbitration. As decision theory is based on the expected utility function, regret theory is based on the non-expected utility function [4], [5].

Regret theory has not been used in literature to analyze the decision of going through arbitration, but it has been used in its role for medical decision-theory, as the risks and weight of regret may be very high, considering the chances of loss of life [6], [7]. Regret theory has also been used to in stock market investments phenomena [8], and also used in hedging behaviour, which is seen to be mainly done due to the chances of regret [9].

There have been several approaches for the quantification of regret. In general, it is quantified as a trade-off method similar to that used in prospect theory to quantify utility within regret theory [10].

A. Illustrative Example

Imagine an example where a person bids \$1 and a fair coin is flipped. If the coin is tails, then the person loses the \$1 paid to play the game. However, if the coin lands in heads, then the person collects \$10. Since there are 50-50 chance of winning or losing outcomes for the game, the total expected value of playing this game is $0.5(10) - 0.5(1) = \$4.50$. Hence, in the long run, the person can make up to 450% more than the amount paid. When this opportunity is provided to individuals, it seems to be a very good deal and people would be willing to take the risks, because the benefits outweigh the costs.

Now, imagine that the person must bid all of his wealth in this game. There are two possible outcomes, either the person wins ten times more what he has bid for, just as in the previous example, or the person loses everything he owns and leaves completely empty-handed and homeless. Although the probability of the outcomes is the same as in the previous example, and although the expected gain is still the same, the person may not consider playing the game, because the risks involved have become much higher. What now occurs in the person's mind is not simply the expected outcome of the game, but the expected regret. Although the person has 50% chance of winning ten times more of the all his wealth, but there is still a 50% chance of being stripped

completely from his wealth.

In the first example, if the person chooses not to play the game and he would have won if he had played, he would have regretted not playing more than the regret of playing the game and losing. In the second example, if the person chooses to play and loses everything he owns, then he will regret playing more than his regret of not playing the game and winning. Consequently, the person may regret more not playing the game than playing the game, but in the second example, the person may regret more playing the game than not playing.

B. Regret in Arbitration

Construction contracts are by its nature multivariate. Therefore, it can never truly go exactly as planned, especially with larger projects. Therefore, problems, variations, and claims would arise naturally in many of the construction contracts. Nonetheless, many of the minor disputes that arise between the contractual parties are usually resolved amicably. However, some disputes may go into arbitration. To understand whether or not going into arbitration is reasonable, a mathematical model is necessary, as it identifies the variables and the risks on either party to raise an arbitration case against the other, and then place it within a numerical matrix to evaluate those risks. Once the risks are evaluated, then a decision whether or not to go through arbitration is determined. It takes into account an approach of which decision will be least regretted. It is ideal for an arbitration model takes into consideration the possible positive or negative outcomes of the arbitration case.

The model proposed is based on the philosophy that if the contracting parties can predict the possible risks and outcomes of an arbitration case, then they would be able to make the right decision. Many of the existing models are based on decision theory tree without taking factors of regret in the model. However, as shown, a regret theory approach makes the model more realistic in evaluating the risks for going to arbitration, and for such, this approach is utilized in the model proposed.

In general, the best decision is not based on the probability of a positive outcome, but based on the probability of regretting a decision for its negative outcome [11]. It is important to get into this approach due to the high risks associated of going through arbitration. Besides the risk of the cost of arbitration, there is also risk of potential future losses due to the negative reputation that might be associated. Consequently, those future losses would be manifested as not getting projects with the same client or from the market. As it is with many disputes that are not resolved amicably, the client may not take it lightly for being taken for arbitration. If the client is large, the contractor may suffer ill-repute with the client, which might cause the contractor to be barred from participating in any potential future tenders, and therefore gets into loss of potential future gains. In other words, even if the contractor is certain to win an arbitration case against a client and is awarded the claim amount, the potential future losses may outweigh the amount of the awarded claim. In such cases, it is important to pursue alternative methods to resolve the dispute amicably.

Although there are scenarios that a contractor may incur

potential future losses, which is a risk that needs to be evaluated within a regret theory framework, it is still necessary to also consider scenarios where the contractor does not raise a claim of a very large amount that would outweigh the potential future gains. In other words, it is also possible for a contractor to regret not proceeding through arbitration. Therefore, there needs to be a comprehensive multivariate evaluation of all possible outcomes.

III. RISKS OF ARBITRATION

A. Rationale of a Regret Approach

Taking another party of a contract to arbitration carries many risks. It may risk the future relationship between both parties, which may be translated as the loss of future opportunities to do business together and therefore make profits. Hence, going to arbitration is more of a commercial decision than a technical decision. There are many trade-off risks that the party taking the other to arbitration needs to consider [12]. Sometimes to avoid any negative outcomes of going to arbitration, it may be wise to negotiate and accept a settlement instead, even if a party has the full rights and the evidence proving a greater claim amount.

Predicting the outcome of construction claims is an important factor to identify whether or not to proceed with arbitration. There are existing models using decision theory that predict construction litigation with different means, such as neural networks [13], decision trees [14], and reasoning approach [15]. However, these models are based on court cases. For the model described in this paper, a similar method as these may be used to identify the probability of winning (P_e), by having strong evidence or based on precedence. The majority of existing predicting models are for litigation and not much are available for arbitration cases.

Nonetheless, in this paper, a regret approach is included to the decision theory model for predicting an outcome. Hence, the model is stochastic in nature and attempts to optimize the maximum benefit that provides the minimum regret. Hence, it is usually imperative to reach an amicable settlement to eliminate or diminish any risks that could cause a decision to arbitrate that eventually has negative consequences. It is important to note that the model proposed does not necessarily predict the outcome of winning or losing an arbitration case, but more specifically determines whether the choice would be potentially regretted in the future or not. Hence, the model predicts the weight of regretting the choice made, whether it is a decision of going through arbitration or the choice to refrain from going through arbitration.

Arbitration is not an easy issue, as it carries with it many variables that need to be taken into consideration. As discussed earlier, dispute is inevitable between two contracting parties, especially in large projects, but it is the method of solving this dispute that may cause either party to regret going into arbitration or not.

B. Challenges by Corrupt Decision-Making

People in decision-making positions may not always be immune to the downfall of professional ethics. This is a natural phenomenon due to cognitive behaviour. If a

decision-maker is rewarded for wrong decisions and/or penalized for correct decisions, then the real corruption is in the system, and not necessarily in the person, as also found in [16] when discussing bonus schemes of top decision-makers in an organization.

For example, if the key performance indicator of a top executive for contract claims with a contractor is dependent on how much claims that this manager can do and win, regardless of the other factors that may cause consequential regret, as portrayed in this model, then the decision-maker may make decisions that would benefit himself with disregard of the overall picture for what is best for the long-term benefit of the organization. The manager may not necessarily be corrupt, but he is being rewarded for taking such decisions, with disregard of the possible consequences that may cause regret to the organization for deciding to pursue an arbitration case. As such, the model proposed using regret theory should be standardized, to reduce or eliminate unintended corruption within the system of evaluation and rewards of decision-makers.

IV. REGRET MODEL FOR ARBITRATION

A. Variables

Arbitration is costly and time-consuming. Several factors are taken into consideration to predict the outcome of arbitration, along with its risks and benefits.

There are several factors that are taken into consideration in dispute resolutions and arbitration cases. Since arbitration is costly and time consuming, then different factors need to be assessed to understand the overall risk of going through arbitration, the predicted results, and the benefits.

The following are the variables that need to be input into the model:

- A = total contract amount
- D = disputed claim amount
- C = cost of arbitration
- N = acceptable negotiated amount
- P_e = probability of winning (having strong evidence and/or based on precedence)
- f = amount of possible effects on current projects' losses
- P_f = probability of current projects' losses
- O = amount of future opportunity loss
- P_o = probability of future opportunity loss with the same client or others, due to loss of market reputation

The probability of winning (P_e) and probability of current and future opportunity loss (P_f , P_o) are all bounded between [0, 1]. The probability of winning depends on having strong evidence and also based on precedence, since it is unfortunate that legal structures have a high dependency on precedence than truthful equity. All costs within this model are dependent on present values of the future costs or benefits, as it is also determined for similar decision theory approaches that deal with quantitative costs [17].

B. Flowchart

The model presented in this paper provides five different steps, as also shown in Fig. 1.

1. Decision to raise a claim

2. Decision to negotiate
3. Decision to accept an amicable settlement
4. Decision to arbitrate
5. Decision of arbitration

For the decision-maker to understand the risks involved to make a decision whether or not to raise a claim, the input of all the variables into the model are necessary to provide a realistic predicted outcome. Not only are the predicted outcomes important, but also the risks involved, as they are used for the evaluation of regret.

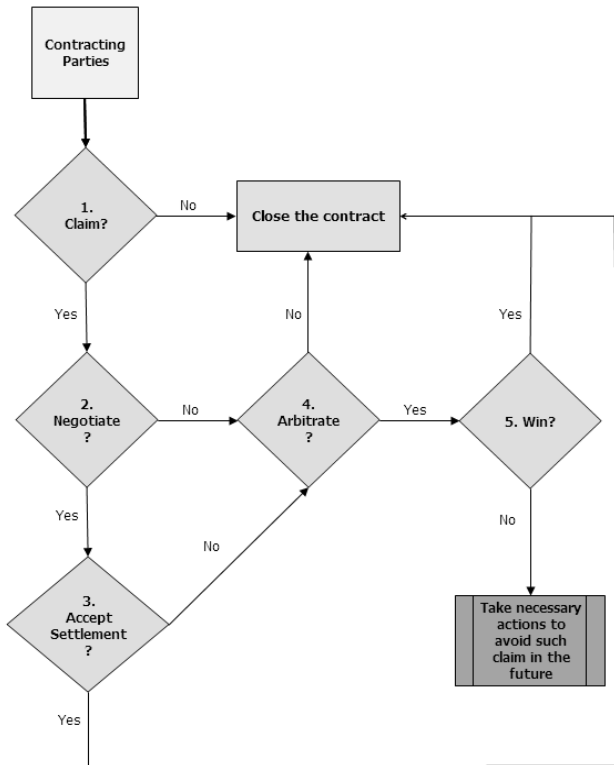


Fig. 1. Claim's flowchart.

C. Matrix

According to decision theory, the following would describe the typical decision flow of going to arbitration.

Step 1:

$P_e(D) > C$? If yes, then

Step 2:

$P_e(D) - C > N$? If yes, then

Step 3:

Is $\frac{P_e(D) - C}{A}$ significant? If yes, then

Step 4:

$P_e(D) > C + P_f(f) + P_o(O)$? If yes, then proceed to arbitration.

However, when looking at it from a regret theory approach, the maximum regret coincides with the maximum loss, which would be due to losing the arbitration case or losing the opportunity of winning the claim if the case did go to arbitration. In such a case, the reputation of the organization falls through in addition to loss of future opportunity with the same client. Therefore, an additional step needs to be included to understand the cost that would be least regretted.

The best outcome is $P_e(D) - C - P_f(f) - P_o(O)$. The worst

outcome is the total cost of $C + P_f(f) + P_o(O)$.

Step 5 (Regret Approach):

$$P_e(D) - C - P_f(f) - P_o(O) > (1 - P_e)[C + P_f(f) + P_o(O)] ?$$

If yes, then proceed to arbitration.

In the extra step above, it is important to predict the outcome whether or not regretting the decision of proceeding with arbitration and losing or not proceeding to arbitration and winning. The last step for a regret approach may be adaptable to any other model available, as the principle of regret is a major factor in realistic decision-making.

D. Analysis

The first step evaluates whether the expected disputed claim amount is greater than the cost of going through arbitration. The expected value of the claim amount is the probability of winning multiplied by the disputed amount. If it were not greater, then there are no reasons to proceed with the model, as it would be an obvious case where the decision would go to arbitration would not be feasible.

The second step looks into whether the negotiated amount for the claim is reasonable. If the negotiated amount is reasonable and is still greater than the expected value of the claim minus the costs of arbitration, then the best deal is to accept the amicable settlement.

The third step is a quantitative measurement whether the amount expected to be gained from the arbitration is significant when compared to the overall contract value. However, this model does not specify what percentage is considered significant, as it is left to the decision-maker to determine the importance of a claim in comparison with the overall contract value. Since the risks could be high, it is necessary sometimes to not consider insignificant amounts for the claims. This model does not take into considerations the principle. Sometimes, a dispute may arise not because the amount is significant, but because one party is taking a stance based on principle. Since principles are very subjective, then quantifying them may not be simple, as each individual may give it a different weight than the other. Hence, this model excludes the logic of going through arbitration due to principle, because in most of these cases, the party going through the process cares less of the material loss or gain, and more interested in the principle that it tries to emphasize.

The fourth step compares the expected value of the claim amount to be won along with the costs of going through arbitration, in addition to the risks of the expected values of loss in other existing projects with the client as well as losses of future opportunities. This step is necessary to quantify the feasibility of going through arbitration while taking into consideration the multivariate risks that are involved.

The first four steps of this model is somewhat typical to decision theory, as it does not provide any additional value than existing models that exist. Nonetheless, as discussed earlier, realistic decisions do not only consider the probabilities or the expected values of gain, but also of regret.

The fifth step considers regret, as part of the decision model. The fifth step is considered as the utility function for regret. It provides a quantitative method to determine the overall risks on whether or not the choice made would be regretted. It could be the choice of going through arbitration, when they should not have, or the choice of not going

through arbitration, when they should have. This extra step makes a significant difference in the decision made. It can easily tip the scales between the decision of going through arbitration or refraining from arbitration.

V. EXAMPLE

The following example in this section is developed to understand the mechanics of the regret theory and how it can significantly affect decision-making. There are various permutations of the number of scenarios that may exist, but a sample of those scenarios is used in this example to illustrate the regret theory approach for the process of going through arbitration.

Table I provides different scenarios grouped into threes. In general, the amounts and costs are considered to be fixed for the purposes of identifying how the percentages of the probabilities may affect the outcomes of the analysis. The example is only shown for illustrative purposes. The first three groups, scenarios 1 to 9, shows the difference when the probabilities is less, equal, or greater than the other probabilities within the group. Each of the first three groups compares the change in the probabilities one at a time, and as such the middle scenario is all equal in all the four groups. In accordance to decision theory, if the probability of an outcome is completely uncertain, then all probabilities may be equally valid. Accordingly, the middle part of each group takes into consideration the possibility that all probabilities are equally valid due to uncertainty. The last group, scenarios 10 to 12 reverses the possible probabilities.

TABLE I: DIFFERENT SCENARIOS ANALYSIS

	Pe	D	C	Pf	f	Po	O	5th Step	5th Step	Result
								Left Side	Right Side	
1	0.1	100	10	0.5	20	0.5	50	-35	40.5	NO
2	0.5	100	10	0.5	20	0.5	50	5	22.5	NO
3	0.9	100	10	0.5	20	0.5	50	45	4.5	YES
4	0.5	100	10	0.1	20	0.5	50	13	18.5	NO
5	0.5	100	10	0.5	20	0.5	50	5	22.5	NO
6	0.5	100	10	0.9	20	0.5	50	-3	26.5	NO
7	0.5	100	10	0.5	20	0.1	50	25	12.5	YES
8	0.5	100	10	0.5	20	0.5	50	5	22.5	NO
9	0.5	100	10	0.5	20	0.9	50	-15	32.5	NO
10	0.1	100	10	0.9	20	0.9	50	-63	65.7	NO
11	0.5	100	10	0.5	20	0.5	50	5	22.5	NO
12	0.9	100	10	0.1	20	0.1	50	73	1.7	YES

The amounts which appear negative for the 5th step on the left side would not have naturally reached the fifth step, because it would have already been stopped at step 4, since the actual expected gain outweighs the costs of arbitration and potential losses on existing and future projects. However, they are portrayed in this example for illustration purposes only when comparing the different scenarios.

The amounts which appear positive for the 5th step on the left side would have all been considered to be good to go through arbitration, when excluding the concept of regret. Therefore, two-thirds of the scenarios, the decision would be to go through arbitration in each of the four groups. However, as regret approach is considered, the scales differ significantly. When considering regret, the first, third, and

fourth groups will make it a good idea to go through arbitration only one-third of the scenarios. On the other hand, the second group would not allow going through arbitration at all, as none of the scenarios finds arbitration as feasible. In other words, all the scenarios of second group evaluate regret at a much higher rate than the actual gains.

By looking at this simple example used for illustration purposes, it becomes evidently clear that when considering regret, then the risks may outweigh the benefits, in accordance to the regret approach when compared with decision theory, which disregards this very important aspect. Regret theory provides a more conservative approach when comparing different outcomes. Accordingly, it is sometimes best to accept an amicable settlement than to go through arbitration, as it will reduce the hassle and costs of arbitration, whether in the short-term or also in the long-term, considering the losses of potential future gains.

VI. CONCLUSION

Going through arbitration carries with it various risks. There are risks that include costs of going through arbitration, but also risks on reputation. A contractor may lose potential future profits by not being allowed to participate in future projects with the client that it has taken into arbitration, even if the contractor has full rights to do so. Hence, going through arbitration is a commercial decision, as it may the risks may outweigh the benefits. Based on this principle, a risk-theory approach is considered.

The consequences of making the wrong decision, whether going through arbitration or refraining from going through arbitration need to be evaluated realistically.

From a similar perspective, it is important to evaluate arbitration through a regret approach, because the consequences of making the wrong decision, whether it is to proceed to arbitration or to refrain from arbitration may culminate to significant amounts lost. Nonetheless, since contracts provide the basis of a relationship between a contractor and a client that relationship must continue to be flourishing to receive additional opportunities in the future. On the other hand, if that relationship turns bad because of an arbitration case even if the contractor has the full rights to it, that may cause loss of future opportunities. Hence, even if the contractor wins the claim, his future losses may become greater.

From within this concept, the model illustrated in this paper adds the regret approach for deciding whether or not to go to arbitration. It is found to be necessary to add a regret approach to make the decision of going through arbitration more realistic and within the limitations of understanding the full risks involved by both parties, keeping in mind the optimized maximum benefit, given the minimum losses. An example is used in this paper to illustrate the differences between a typical decision-theory and regret theory approaches. It has also been shown that standardizing the decision-making technique for going through arbitration based on regret may help in reducing or eliminating wrong decisions made by decision-makers that might benefit themselves due to a corrupt system, while deemed as regretful to the organization in the long-term.

More research is needed in the future to refine the model for regret through an empirical approach, as it is essential to understand the robustness of this model pragmatically. Other considerations that need to be taken into account in future studies of this model includes a fuzzy logic analysis, to determine at what level of tolerance would a choice be changed from one to another, if it truly mattered at that point. Also, other considerations that need to be taken into account in future research of this model is to make a sensitivity test for the variables involved to further understand the robustness of the model.

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