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"Logistic Regression Modeling of Construction Negotiation Outcomes"

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by

Tak Wing Yiu*, Sai On Cheung and Pui Ting Chow
Construction Dispute Resolution Research Unit
Department of Building and Construction
City University of Hong Kong

*Corresponding Author

Tak Wing Yiu*

Construction Dispute Resolution Research Unit
Department of Building and Construction
City University of Hong Kong
83 Tat Chee Avenue
Hong Kong

Tel: 852-34426779
Fax: 852-27887612
Email: bctwyiu@cityu.edu.hk

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Logistic Regression Modeling of Construction Negotiation Outcomes

Tak Wing Yiu, Sai On Cheung and Pui Ting Chow
Construction Dispute Resolution Research Unit
Department of Building and Construction
City University of Hong Kong

Key Words: Construction Negotiation, Negotiator Tactics, Negotiation Outcomes, Logistic Regression

Abstract

Construction disputes are always negotiated before other resolution methods are considered. When it comes to negotiation, the tactics used by a negotiator is central in deriving desired outcomes. This paper reports a study that employs Logistic Regression (LR) to predict the probabilistic relationship between negotiator tactics and negotiation outcomes. To achieve this, three main stages of work were involved. Negotiator tactics and negotiation outcomes were firstly identified from literature. Then, four LR prediction models with negotiation outcomes as the dependent variable and negotiator tactics as the independent variables were constructed. Finally, these models were validated with an independent set of testing data. These models collectively suggested that (1) increasing time pressure, taking threats or subject the opponent to reality testing are inductive to 'Deterioration' negotiation outcomes; (2) providing various options and increasing flexibility would achieve 'Substantial Improvement' in negotiation; (3) relationships between parties could be maintained by fair play and (4) focusing on information exchange, giving mid-discussion summaries and offering counter-proposal could clarify a party's position. Despite the skepticism over frank and open discussion of the issues and the existence of game

plan, the findings of this study do support some well-established negotiation principle – focuses on the issue and play down behavioral factors.

Introduction

Negotiation is a process in which two or more parties make a joint decision with regard to issues that are initially different in preference [1]. In construction, these parties are the representatives of contractor or client, individual consultants or a group of project team members. During the course of construction, divergence of interests and incompatibility of preferences are often found among contracting parties, which would subsequently turn into claims and even disputes. These claims and disputes are in practice to be first negotiated in an attempt to reach a mutually acceptable solution with no harm to their collaborative relationship [2]. Hence, as suggested by Ren et al. [3], negotiation plays an important part in preventing disputes, resolving claims, and achieving harmony for all. Under the regime of construction contracts[i, ii], contractual disputes shall be referred to designated 'third party', who are typically the engineer or architect of the project for decision (Table 1 refers). It is often expedient to negotiate an agreement rather than leaving it to their decisions so as to promote early settlement. In particular, the financial burden of disrupted construction programmes and resorting to other formal dispute resolution alternatives should be avoided.

<Table 1 here>

[i]The Hong Kong Institute of Architects, The Hong Kong Institute of Construction Managers, The Hong Kong Institute of Surveyors (2005). Agreement & Schedule of Conditions of Building Contract for use in the Hong Kong Special Administrative Region. Private Edition – With Qualities. Hong Kong SAR, China.

[ii] The Government of the Hong Kong Special Administrative Region (1999). General Conditions of Contract for Building Works.

Hence, construction practitioners shall endeavor to resolve disputes through negotiation. To have a successful negotiation, it is of vital importance to manage it proactively and effectively [4]. The use of appropriate tactics should be an integral part of the overall negotiation plan [5-6]. In order to study the effectiveness of different negotiator tactics, previous negotiation researches in the fields of psychology and social science have focused on examining the influence of negotiator tactics and negotiation outcomes [5-8]. Some of the findings suggest that the use of negotiator tactics plays a pivotal role in facilitating settlement, that is, the desired negotiation outcome. In fact the attainment or otherwise of a settlement is a reliable measure of project dispute resolution satisfaction [9-10]. Managing dispute has become an important part of engineering management. Analytical tools to evaluate the likelihood of dispute occurrence have been reported [49][59]. Despite the apparent importance, empirically based study on negotiator tactics in engineering and construction dispute negotiation remains uncommon. This paper presents a logistic regression (LR) model which investigates the probability of achieving certain negotiation outcomes respective to the negotiator tactics. The LR model was developed based on 92 construction dispute negotiation cases in Hong Kong. The three main stages of work are: -

1. Identification of negotiator tactics and negotiation outcomes in the construction industry;
2. Likelihood assessment of negotiation outcomes; and
3. Model validation

The advantages of using LR are outlined in the section with the heading Stage 2 ‘Likelihood Assessment of Negotiation Outcomes’. The overall research design framework and research plan are given in Figure 1 and Table 2 respectively.

<Figure 1 here>

<Table 2 here>

Stage 1: Identification of Negotiator Tactics and Negotiation Outcomes

A literature review was first performed to list out negotiator tactics and negotiation outcomes. For the development of a LR model, case specific data on tactics used and outcome attained are needed and were collected through a questionnaire survey. Tables 3 and 4 summarize the tactics and outcomes identified from the literature review.

<Table 3 here>

<Table 4 here>

A total of 92 previously completed negotiation cases were collected over three months of data collection through an industry-wide questionnaire survey. Firstly 230 construction professionals were longlisted and contacted for agreement of participation. The targeted respondents were construction professionals from the government, private developers, consultancy firms and contractors randomly selected from builder directories and government web-pages. Over 55 % of the respondents had at least 10 years experience in construction negotiation. The project nature of the negotiated disputes were civil (15.2%), building (53.3%) building services (13.0%), Maintenance (6.5%), and others (18.5%).

As the data needs to be case specific, the respondents were asked to select one of the most recently completed negotiation cases for completion of the questionnaire. The designed questionnaire has three major sections. The first section requires the

respondents to provide their background information and particulars of the negotiated cases such as the project nature, contract sum and parties involved. The next two sections are to rate the degree of usefulness of negotiator tactics on a Likert scale of 1(least useful) to 7 (most useful), and the degree of achievement of negotiation outcomes on the same scale of 1 (not achieved) to 7 (highly achieved).

Taxonomies of Negotiation Outcomes

In order to consolidate the results and facilitate interpretation, Principal Component Factor Analysis (PCFA) was used to explore the data structure of the negotiation outcomes so as to establish a set of common underlying constructs. Separate dimensions of the structure were first identified. Interpretation was then accomplished by summarizing the data according to the constructs [44]. The data obtained for the negotiation outcomes was subjected to PCFA in developing its taxonomies. As shown in Table 4, the PCFA results satisfied the statistical fitness criteria of Kaiser-Meyer-Olkin (KMO) and Bartlett's Test (BT). The KMO value for PCFA was 0.808 which was above the threshold of 0.5 [9][45-46], while the low significance in the Bartlett Test suggested adequacy of the data set to perform PCFA. The taxonomies of the negotiation outcomes for use in the next two stages of this study are shown in Table 5. Details of the statistical fitness criteria for these taxonomies are also provided.

<Table 5 here>

Stage 2: Likelihood Assessment of Negotiation Outcomes

To assess the likelihood of the negotiation outcomes, the reported negotiator tactics and the taxonomies of negotiation outcomes developed in Stage 1 were used as

variables for the Logistic Regression (LR) analysis. LR analysis is a statistical technique for assessing the likelihood of events. LR would produce a logistic equation that calculates the probability of occurrence of the dependent variable as a function of the independent variables. It has been used in construction management researches such as prediction of contractor performance [47], contractor failure [48] and occurrence of contract disputes [49]. The dichotomous occurrence of the dependent variable is typically designated as 1 or 0. In this study, 1 represents achievement and 0 represents non-achievement of negotiation outcomes. Statistically, an LR model predicts the odds of an event occurring. If P is the probability of an event, the odds of that event are:-

$$\text{Odds} = \frac{P}{(1-P)} \quad \ldots\ldots(1)$$

The probability function can be presented as:

$$\ln\left(\frac{P}{1-P}\right) = a_0 + a_1T_1 + a_2T_2 + \ldots + a_nT_n \quad \ldots\ldots(2)$$

Or

$$P = \frac{1}{1+e^{-(NO)}} \quad \ldots\ldots(3)$$

where $NO = a_0 + a_1T_1 + a_2T_2 + \ldots + a_nT_n$; P is the probability of occurrence of negotiation outcomes; a_0 = constant; a_n = coefficient estimated from the data; and $T_{1\ldots}T_n$ = the independent variables (i.e. negotiator tactics).

When considering the probability of achieving certain negotiation outcomes, the above logistic model will describe a probability with a cut off value at 0.5 [47]. In this study, Logistic Regression was used to: (1) predict the dependent variables, i.e. negotiation outcome, which is either ‘achieved’ or ‘not achieved’; (2) demonstrate the effect of the independent variables, i.e. negotiator tactics, on the dichotomous dependent variable and (3) produce negotiation outcome prediction models. With the four factors derived from the taxonomies of negotiation outcomes, four LR prediction models take the forms of:-

$$NO_{\text{deterioration}} = a_0 + a_1T_1 + a_2T_2 + ... + a_{17}T_{17} \quad \text{(4)}$$

$$NO_{\text{substantial improvement}} = a_0 + a_1T_1 + a_2T_2 + ... + a_{17}T_{17} \quad \text{(5)}$$

$$NO_{\text{maintaining parties' relationship}} = a_0 + a_1T_1 + a_2T_2 + ... + a_{17}T_{17} \quad \text{(6)}$$

$$NO_{\text{position clarification}} = a_0 + a_1T_1 + a_2T_2 + ... + a_{17}T_{17} \quad \text{(7)}$$

where NO_i represents negotiation outcomes, i.e. the dependent variables; a_0 is constant; a_1, a_2, ... and a_n are coefficients; $T_1, T_2 \ldots T_{17}$ represent the reported use of the 17 negotiator tactics (i.e. the independent variables) as tabulated in Table 3. Relating the set of negotiator tactics (T_n) to a negotiation outcome (NO) is in effect analyzing a multivariate relationship.

Cluster Analysis and Multiple Regression can perform classification and correlation analysis respectively, but both require metric data [47]. In this study, the dependent variable (i.e. ‘achieved’ and ‘not achieved’) is dichotomous, hence is categorical. LR offers the advantages of accepting dependent variable that is categorical [47][50-52].

Data Treatment

To facilitate model development and validation, the collected 92 sets of data were divided into: Modeling Data (Set A) and Testing Data (Set B) [47]. The LR model is derived from 72 sets of data (i.e. Set A data) and tested by 20 independent sets of data (i.e. Set B data). According to the taxonomies of the negotiation outcomes, factor scales were created for use in the LR analyses. These scales represented the composite measure created for each observation on each factor extracted in the Principal Component Factor Analysis (PCFA) [44]. This technique has been used in Logistic Regression Model on bid decisions [55]. Furthermore, the dichotomous dependent variables (1 and 0) are defined by: -

- 1: Outcome achieved: $3.5 < \text{Degree of Achievement} \leq 7$
- 0: Outcome not achieved: $1 \leq \text{Degree of Achievement} \leq 3.5$

Likewise, the above approach of defining dichotomous outcome was applied by Diekmann and Girard [49] in analyzing the likelihood of dispute occurrence. As described in Table 3, a total of seventeen negotiator tactics were identified and four factor scales were developed for the taxonomies of the negotiation outcomes (Table 5 refers). These seventeen negotiator tactics were used to regress on each factor scale. Hence a total of four LR prediction models were developed in this study. For each analysis, stepwise procedure was employed to select statistically significant independent variables in the LR model. The estimated coefficients and the related statistics of each final LR models are given in the following section.

LR Models

Table 6 summarizes the stepwise LR results. With “Deterioration” outcome as the dependent variable, the LR analysis was completed in three steps with three negotiator tactics, “I attempted to increase time pressure by mentioning the deadline of negotiation” (t_02), “I increased argumentation, threats and assertion of needs”, (t_09) and “I gave occasional summaries to subject the opponent to reality testing” (t_14), included in the logistic equation. These independent variables attained a chi-square score of 5.25 that met the p value criterion (with p value less than 0.05 statistically significant) and therefore were selected in the model. As a result, 77.80% of 72 cases were correctly predicted. Similarly, two negotiator tactics, “I brainstormed various options based on the interests of all parties” (t_10) and “For an open agenda, I retained my flexibility until the close of negotiation” (t_25), were identified when “Substantial Improvement” acted as the dependent variable. During Step 1 of the selection process, the independent variable with the highest chi-square score (11.19) that met the p value criterion would be selected in the model. This process was repeated until Step 2 was reached. The final chi-square score was 8.65 with an overall hit rate of 95.80%. When another LR model conclude the dependent variables “Maintaining Parties’ Relationship” and “I tried to employ fair objective criteria, standards and procedures” (t_12), 84.70% of the 72 cases were correctly predicted. With “Position Clarification” as the dependent variable, 3 steps of LR were performed to develop the final LR model. This model included three independent variables--- “I used information exchange as a mechanism for establishing trust” (t_17), “I encouraged colleagues to give mid-discussion summaries” (t_18) and “I gave counter-proposal to the other parties’ offer” (t_24), with the prediction accuracy increasing from 91.70% to 95.80%. Details of entire cases that were correctly classified computed from Set A data are shown in Table 7.

<Table 6 here>

<Table 7 here>

Coefficients for Logistic Regression

Table 8 shows the estimated coefficients and related statistics of the four LR models. It also shows the combinations of a constant and the statistically significant variables identified in each of the developed LR models for each of the four negotiation outcomes. The four prediction models of negotiation outcomes can be represented as:

$$NO_{Deterioration} = -6.324 + 0.668T_{t\_02} + 0.750T_{t\_09} + 0.635T_{t\_14} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(8)}$$

$$\mathrm{NO}_{\mathrm{Substantial\ Improvement}} = -7.343 + 1.187\mathrm{T}_{\mathrm{t\_10}} + 1.341\mathrm{T}_{\mathrm{t\_25}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(9)}$$

$$\mathrm{NO}_{\mathrm{Maintaining\ Parties'\ Relationship}} = -1.886 + 0.764\mathrm{T}_{\mathrm{t\_12}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(10)}$$

$$\mathrm{NO}_{\mathrm{Position\ Clarification}} = -5.562 - 1.160\mathrm{T}_{\mathrm{t\_17}} + 1.430\mathrm{T}_{\mathrm{t\_18}} + 2.183\mathrm{T}_{\mathrm{t\_24}} \ldots\ldots\ldots\ldots\ldots\ldots \text{(11)}$$

<Table 8 here>

Stage 3: Model Validation

The reliability of the four LR models depends on how well they predict the negotiation outcomes outside the modeling data [54]. In order to validate their prediction reliabilities, 20 independent sets of testing data (Set B) were used. As suggested by Russell and Jaselskis [48]; Salem *et al.* [54]; Wong [47], the cut-off value used was 50% for the purpose of prediction accuracy. Tables 9 to 12 below present the prediction results.

<Table 9 here>

<Table 10 here>

<Table 11 here>

<Table 12 here>

Based on the above statistics, it was found that the four LR models could predict negotiation outcomes with fairly high accuracy as the success classification rates ranged from 70% to 95%. The LR model of "Substantial Improvement" outcome appeared to predict particularly well with 95% of the 20 cases correctly predicted (Table 10 refers). Previous works of Lowe and Parvar [55]; Keil et al. [56](2003) and Wong [47] were also demonstrated high prediction capability of LR models. Lowe and Parvar [55] developed a reliable LR model (with the hit rate of 96.5%) of the bid/no-bid decision-making process. Keil et al. [56]'s LR model exhibited a hit rate of 91%, which provided a strong evidence of the validity of project management constructs in predicting project escalation. While a hit rate of 93.75% was obtained by Wong [47]'s LR models of contractor performance. In sum, a high hit rate is a good indicator of the reliability of a LR model. It is further suggested that these models could assist negotiators in formulating their tactics with respect to the desired outcomes.

Discussion

Statistically, the negotiator tactics selected in each of the LR models can be used to predict the occurrence of the respective outcomes. Equations (8) – (11) present the final LR prediction models of the four negotiation outcomes respectively:-

$$NO_{Deterioration} = -6.324 + 0.668T_{t\_02} + 0.750T_{t\_09} + 0.635T_{t\_14} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(8)}$$

$$\mathrm{NO}_{\mathrm{Substantial\ Improvement}} = -7.343 + 1.187\mathrm{T}_{t\_10} + 1.341\mathrm{T}_{t\_25} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(9)}$$

$$\mathrm{NO}_{\mathrm{Maintaining\ Parties'\ Relationship}} = -1.886 + 0.764\mathrm{T}_{t\_12} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(10)}$$

$$\mathrm{NO}_{\mathrm{Position\ Clarification}} = -5.562 - 1.160\mathrm{T}_{t\_17} + 1.430\mathrm{T}_{t\_18} + 2.183\mathrm{T}_{t\_24} \ldots\ldots\ldots\ldots\ldots\ldots \text{(11)}$$

To illustrate the use of these models, let us take the LR prediction model of "Deterioration" negotiation outcome (Equation (8) refers) as an example. Consider a negotiation case in which a negotiator has employed the three tactics (i.e. t_02, t_09 and t_14) of this model and he evaluates their degree of usefulness as 7 of the Likert scale (i.e. the highest score) in this negotiation. By substituting these input data into this prediction model, $NO_{Deterioration}$ is found to be 8.047 (Equation (12) refers):

$$\begin{aligned}\mathrm{NO}_{\mathrm{Deterioration}} &= -6.324 + 0.668(7) + 0.750(7) + 0.635(7) \\ &= 8.047\end{aligned} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(12)}$$

Hence, the probability of occurrence of "Deterioration" outcome can be obtained by substituting this value to Equation (3).

$$\mathrm{P} = \frac{1}{1 + \mathrm{e}^{-(\mathrm{NO}_{\mathrm{deterioration}})}} = \frac{1}{1 + \mathrm{e}^{-(8.047)}} = 0.9997 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(13)}$$

This suggests that this negotiation case has approximately 99.97% probability of reaching "Deterioration" outcome. Likewise, if the negotiator evaluates these tactics as not useful by giving 1 in the Likert scale (i.e. the lowest score), the result suggests

that this negotiation case has only a 1.38% chance of reaching "Deterioration" outcome (t_02, t_09 and t_14). Similar analyses can also be performed in other prediction models (Equations (14) – (17) refer). The sensitivity of negotiator tactics on certain negotiation outcomes can be detected by noting the change in the logistic probability associated with changes in tactic scales. These sensitivity analyses can be performed to enrich further understanding on the usefulness of negotiator tactics and their impacts on the probabilities of achieving the negotiation outcomes of the four prediction models [47].

$$P(NO_{\text{Deterioration}}) = \frac{1}{1+e^{-(-6.324+0.668T_{t\_02}+0.750T_{t\_09}+0.635T_{t\_14})}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(14)$$

$$P(NO_{\text{Substantial Improvement}}) = \frac{1}{1+e^{-(-7.343+1.187T_{t\_10}+1.341T_{t\_25})}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(15)$$

$$P(NO_{\text{Maintaining Parties' Relationship}}) = \frac{1}{1+e^{-(-1.886+0.764T_{t\_12})}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(16)$$

$$P(NO_{\text{Position Clarification}}) = \frac{1}{1+e^{-(-5.562-1.160T_{t\_17}+1.430T_{t\_18}+2.183T_{t\_24})}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(17)$$

For example, Figure 2 demonstrates how the probabilities of reaching 'Substantial Improvement' negotiation outcome change with the degree of usefulness (from 1: least useful to 7: most useful) of "I brainstormed various options based on the interests of all parties" (t_10) and "For an open agenda, I retained my flexibility until the close of negotiation" (t_25). As the prediction model of 'Substantial Improvement' negotiation outcome is composed of two independent variables, their respective figures can also show the relative impact of applying different degree of usefulness of the negotiator tactics. A probabilistic map can be plotted to demonstrate

this effect (Figure 2 refers). In this map, the probabilities of achieving 'Substantial Improvement' negotiation outcome are displayed for all combinations of degree of usefulness of t_25 and t_10.

<Figure 2 here>

Likewise, similar maps can be constructed for the probabilities of reaching 'Deterioration' and 'Position Clarification' negotiation outcomes. As these two prediction models are both composed of three independents variables respectively, probabilistic maps can be plotted by keeping the degree of usefulness of one tactic constant. Figure 3 demonstrates how the probabilities of achieving 'Maintaining Parties Relationship' negotiation outcome change with a single independent variable, i.e. the degree of usefulness of t-12

<Figure 3 here>

Generally, the probability of reaching the four negotiation outcomes increases with high degree of usefulness of their respective negotiator tactics in the prediction models. Hence, the four LR prediction models support the proposition that there is correlation between negotiator tactics and negotiation outcomes. For example, in order to prevent undesirable outcomes, construction negotiators shall renounce the use of tactics such as increasing time pressure, taking threats or subject the opponent to reality testing. They also affirm that negotiators shall remain impartial during the negotiation process in order to maintain parties' relationships. To achieve this, they should focus on finding and selecting the criteria that can be accepted by the other parties. It also helps to engender trust between contracted parties. In sum, with wider

adoption of negotiation in the construction industry, this paper reports a study of using LR as a tool to analyze probabilistic relationships between negotiator tactics and negotiation outcomes. The results suggest that construction dispute negotiators should understand that some tactics are associated with certain negotiation outcomes, and they should employ tactics appropriately to optimize the outcome.

Limitations and Further Studies

This study employs Logistic Regression to predict the probabilistic relationship between negotiator tactics and negotiation outcomes. In this study, data obtained are based on the self-report negotiation case recently completed by the respondents. Although this approach is widely adopted by the researchers of construction management, the author would highlight the possibility of encountering retrospective error from the respondents [57][58], i.e. the accuracy of retrospective data is subject to the respondents' memory. Hence this caveat should be noted in this type of modeling. Having said that, the practical limitation of recording longitudinal data on negotiation is also difficult to overcome. It is suggested that the reliability of the data shall be considered in the light of the particulars of the respondents. The respondents of this study are construction professionals from the government, private developers, consultancy firms and contractors. About half of them had at least 10 years experience in construction negotiation. The effect of retrospective error would be less then the other non-construction related negotiation studies which are often conducted with college students.

Concluding Remarks

Negotiation has been the preferred way to resolve dispute in the construction industry. Effective negotiation would suppress wasteful consumption of resources to handle disputes. The prospect of reaching favorable negotiation outcomes is affected by the tactics used by negotiators. Hence, the achievement of certain negotiation outcomes correlates with the tactics used by the negotiation. This paper describes a study that employs Logistic Regression (LR) to examine this probabilistic relationship. Firstly, negotiator tactics and negotiation outcomes were longlisted through a literature review. Secondly, taxonomies of negotiation outcomes were developed by a PCFA. LR prediction models with negotiation outcomes as the dependent variable and negotiator tactics as the independent variables were constructed. Finally, prediction reliabilities of the developed LR models were validated with independent sets of testing data. Four LR prediction models were then developed as a result. These suggested that (1) increasing time pressure, taking threats or subject the opponent to reality testing are inductive to 'Deterioration' negotiation outcomes; (2) providing various options and increasing flexibility would achieve 'Substantial Improvement' in negotiation; (3) relationships between parties could be maintained by fair play and (4) focusing on information exchange, giving mid-discussion summaries and offering counter-proposal could clarify a party's position. Despite the skepticism over frank and open discussion of the issues and the existence of game plan, the findings of this study do support some well-established negotiation principle – focuses on the issue and play down behavioral factors.

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Table 1 Provisions of Dispute Settlement in Standard Forms of Building Contracts in Hong Kong

	Standard Forms of Building Contracts	
	for *Private* Development	**for *Government* Development**
First Step to Dispute Settlement*	Clause 41(2): *"If a dispute arises under or in connection with the Contract, the Architect shall, at the request of either party, immediately refer the dispute to the Designated Representatives."*	Clause 86(1): *"If any dispute of difference of any kind whatsoever shall arise between Employer and the Contractor in connection with or arising out of the Contract…it shall be referred to and settled by the Architect who shall state his decision in writing and give notice of the same to the Employers and the Contractor."*

* Failure of the first step would trigger mediation process. If disputes cannot be settled by mediation, arbitration would be employed.

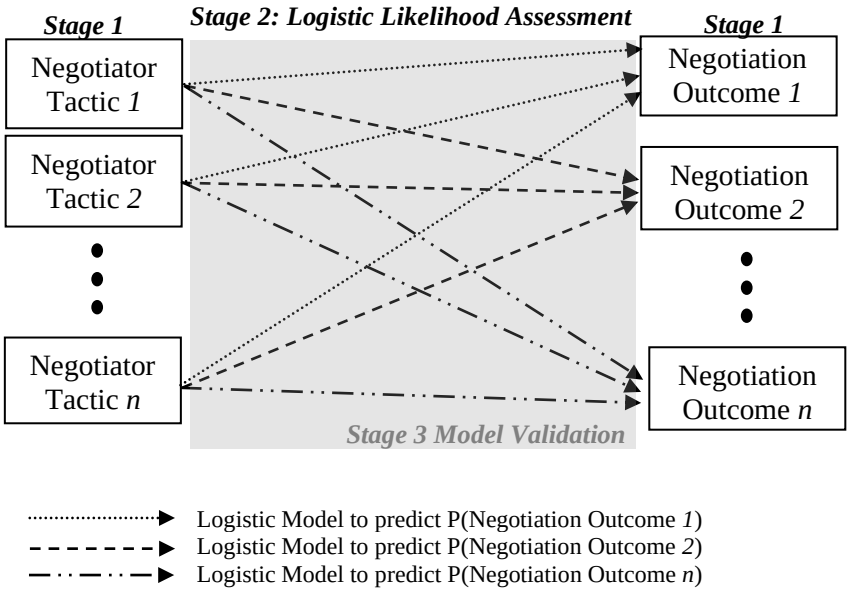

Figure 1 Overall Design Framework

Table 2 An Overall Research Plan

Stage	Research Tasks	Methodology	Deliverables
1	Identification of Negotiator Tactics and Negotiation Outcomes	• Literature Review • Questionnaire survey • Principal Component Factor Analysis (PCFA)	• Lists of negotiator tactics and negotiation outcomes. • Taxonomies of Negotiation Outcomes
2	Likelihood Assessment of Negotiation Outcomes	• Data Treatment: Dividing the data into two sets: Modeling Data (Set A) and Testing Data (Set B) • By using the Modeling Data, perform Logistic Regression (LR)	• LR models
3	Model Validation	• By using the Testing Data, validate the LR prediction models developed from Stage 2. • Evaluate the accuracy of prediction.	• Validated LR models for the prediction of negotiation outcomes.

Table 3 List of Negotiator Tactics

Code	***Negotiator Tactics[a]***	***Reference***
t_01	I tried to identify the core issues and clarify where each party stands	[11]
t_02	I attempted to increase time pressure by mentioning the deadline of negotiation	[12-13]
t_03	I focused on the sequence of issues to be discussed and bundled the related issues only	[11]
t_04	I maximized the information received while minimizing the information given	[14-15]
t_05	I began with easy issues on common ground	[11]
t_06	I mentioned the increase in costs associated with continuing disputes	[13][16]
t_07	I made argument in support of my own position	[12]
t_08	I attempted to reveal and acknowledge personal feelings	[17]
t_09	I increased argumentation, threats and assertion of needs	[18]
t_10	I brainstormed various options based on the interests of all parties	[11][19]
t_11	I used my authority to make decision in my favor	[20]
t_12	I tried to employ fair and objective criteria, standards and procedures	[17][21-22]
t_13	I pretended not to be in a hurry nor interested in the issues in discussion	[23]
t_14	I gave occasional summaries to subject the opponent to reality testing	[17]
t_15	I tried to hide my bottom line	[23]
t_16	I tried to pay others for information	
t_17	I used information exchange as a mechanism for establishing trust	[24]
t_18	I encouraged colleagues to give mid-discussion summaries	[23]
t_19	I suggested a range of options or trade-offs across issues	[24]
t_20	I attributed bad faith to the other parties which I found to be wrong	[24]
t_21	I tried to place a high priority on achieving the other parties' goals	[27]
t_22	I stated requirement and expected compliance	[24]
t_23	I accepted the other parties' point of view but not their offer	[26]
t_24	I gave counter-proposal to the other parties' offer	[24]
t_25	For an open agenda, I retained my flexibility until the end of negotiation	
t_26	I attempted to get opportunities for breaks and caucuses	[11]
t_27	I attempted to get an agreement of the parties upon a set of norms, standards or criteria	

[a] Negotiator tactics were rated on a Likert scale from (1) least useful to (7) most useful

Table 4 List of Negotiation Outcomes

Code	***Negotiation Outcomes***[b]	***References***
o_1	Innovation, creativity and growth in the organization were stimulated	[28-29]
o_2	Job stress, burnout and dissatisfaction made people feel defeated and demeaned	
o_3	Communication between individuals and groups were reduced	[28]
o_4	The negotiating parties were forced to articulate and clarify their positions	[17][28-29]
o_5	The relationships between groups and individuals were damaged	[28-29]
o_6	An optimal synergistic and beneficial solution was created	[27-28][30-31]
o_7	Job performance was worsened because of wasted resources	[28][31]
o_8	Active or passive resistance to change was increased	[28-29]
o_9	Organizational commitment and loyalty were affected as individuals or groups unduly considered more on their own narrow interests	[28-29]
o_10	Positional and irrelevant argument, and even personal attack were resulted	[32-33]
o_11	It stimulated discussions about the workability of solutions	[34]
o_12	Information exchange reduced and even false information was used	[13][34-35]
o_13	A greater level of agreement with the other parties' proposal was resulted	[14][36-37]
o_14	Stalemate, deadlock or impasse appeared	[27-28][37-40]
o_15	The time in generating solutions was reduced	[41]
o_16	Relationship between parties was kept intact and the possibility of dealing with each other in the future increased	[17][42-43]
o_17	Trust was developed between parties and more behavioral compliance was achieved	[31][43]

[b] Negotiation outcomes were rated on a Likert scale from (1) not achieved to (7) highly achieved

Table 5 Taxonomies of the Negotiation Outcomes (adopted from Yiu [53])

	Statistical Fitness Criteria			
	KMO* Value	Bartlett's Test (BT)		
		Approx. Chi-Square	df	Sig.
Taxonomies of Negotiation Outcomes				
Factor 1- Deterioration				
Stalemate, deadlock or impasse appeared				
Organizational commitment and loyalty were affected by individuals or groups				
The relationships between groups and individuals were damaged				
Job stress, burnout and dissatisfaction made people feel defeated and demeaned				
Job performance was worsened because of wasted resources				
Communication between individuals and groups were reduced				
Active or passive resistance to change was increased				
Information exchange reduced and even false information was used	.808	1030.395	276	.000
Positional and irrelevant argument, and even personal attack were resulted				
Factor 2 - Substantial Improvement				
A greater level of agreement with the other parties' proposal was resulted				
It stimulated discussions about the workability of solutions				
Innovation, creativity and growth in the organization were stimulated				
The time in generating solutions was reduced				
An optimal synergistic and beneficial solution was created				
Factor 3- Maintaining Parties' Relationship				
Trust was developed between parties and more behavioral compliance was achieved				
Relationship between parties was kept intact and the possibility of dealing with each other in the future increased				
Factor 4 - Position Clarification				
The negotiating parties were forced to articulate and clarify their positions				

* Kaiser-Meyer-Olkin Measure of Sampling Adequacy

Table 6 Stepwise Logistic Regression Statistics

Dependent Variable	Step	Chi-sq.	df	Sig[1]	Class %	Variable
Deterioration	1	9.85	1	.002	83.30	t_14
	2	6.15	1	.013	80.60	t_09, t_14
	3	5.25	1	.022	77.80	t_02, t_09, t_14
Substantial Improvement	1	11.19	1	.001	91.70	t_25
	2	8.65	1	.003	95.80	t_10, t_25
Maintaining Parties' Relationship	1	8.25	1	.004	84.70	t_12
Position Clarification	1	14.68	1	.000	91.70	t_24
	2	6.70	1	.010	94.40	t_18, t_24
	3	4.67	1	.031	95.80	t_17, t_18, t_24

[1]p value significant at 0.05.

Table 7 Logistic Regression Classification Table

Negotiation Outcomes (Dependent Variable)	Negotiator Tactics (Independent Variable)	Observed		Predicted		
				Achieved A	No Achieved N	Hit Rate
Deterioration	t_02, t_09, t_14	Achieved	A	3	11	21.40
		Not Achieved	N	5	53	91.40
						Overall 77.80%
Substantial Improvement	t_10, t_25	Achieved	A	4	3	57.10
		Not Achieved	N	0	65	100.0
						Overall 95.80%
Maintaining Parties' Relationship	t_12	Achieved	A	2	10	16.70
		Not Achieved	N	1	59	98.30
						Overall 84.70%
Position Clarification	t_17, t_18, t_24	Achieved	A	5	2	71.40
		Not Achieved	N	1	64	98.50
						Overall 95.80%

Note: Cut value is 0.50

Table 8 Coefficients of Logistic Regression

Dependent Variable	Variable	B	S.E.	Wald	Df	Sig	Exp(B)
Deterioration	t_02	.668	.312	4.589	1	.032	1.950
	t_09	.750	.290	6.716	1	.010	2.118
	t_14	.635	.296	4.593	1	.032	1.888
	constant	-6.324	2.232	8.026	1	.005	.002
Substantial Improvement	t_10	1.187	.467	6.447	1	.011	3.277
	t_25	1.341	.476	7.938	1	.005	3.823
	constant	-7.343	2.757	7.091	1	.008	.001
Maintaining Parties'	t_12	.764	.290	6.954	1	.008	2.146
Relationship	constant	-1.886	1.283	2.160	1	.142	.152
Position Clarification	t_17	-1.160	.622	3.479	1	.062	.313
	t_18	1.430	.565	6.398	1	.011	4.177
	t_24	2.183	.765	8.147	1	.004	8.874
	constant	-5.562	3.384	2.701	1	.100	.004

Table 9 Model Validation of LR Model of "Deterioration" Negotiation Outcomes

Set B: Testing Data (20 cases)						Cut-off Value = 50%	
No	t_02	t_09	t_14	Y-scores [a]	Original	Probabilities [b]	Prediction [c]
1	6	5	5	4.609	Achieved	99.01%	Achieved
2	1	1	6	-1.096	Not Achieved	25.05%	Not Achieved
3	2	2	4	-0.948	Not Achieved	27.93%	Not Achieved
4	5	5	4	3.306	Achieved	96.46%	Achieved
5	4	6	5	4.023	Achieved	98.24%	Achieved
6	1	5	6	1.904	Achieved	87.03%	Achieved
7	4	4	5	2.523	Achieved	92.57%	Achieved
8	6	3	5	3.109	Not Achieved	95.73%	Achieved
9	2	4	2	-0.718	Not Achieved	32.78%	Not Achieved
10	5	3	5	2.441	Achieved	91.99%	Achieved
11	5	4	6	3.826	Achieved	97.87%	Achieved
12	3	5	5	2.605	Achieved	93.12%	Achieved
13	4	3	5	1.773	Achieved	85.48%	Achieved
14	4	1	5	0.273	Achieved	56.78%	Achieved
15	3	2	5	0.355	Achieved	58.78%	Achieved
16	5	4	3	1.921	Achieved	87.22%	Achieved
17	6	3	5	3.109	Not Achieved	95.73%	Achieved
18	2	4	4	0.552	Achieved	63.46%	Achieved
19	6	4	4	3.224	Not Achieved	96.17%	Achieved
20	4	2	6	1.658	Not Achieved	84.00%	Achieved

[a] Equation (8) refers

[b] Probabilities = $1/(1+e^{-[-6.324+0.668(t\_02)+0.750(t\_09)+0.635(t\_14)]})$

[c] Four cases were wrongly classified and 80% of testing data (Set B) correctly classified

Table 10 Model Validation of LR Model of "Substantial Improvement" Negotiation Outcomes

Set B: Testing Data (20 cases)					Cut-off Value = 50%	
No	t_10	t_25	Y-scores [a]	Original	Probabilities [b]	Prediction [c]
1	7	7	10.353	Achieved	99.97%	Achieved
2	5	4	3.956	Achieved	98.12%	Achieved
3	7	7	10.353	Achieved	99.97%	Achieved
4	3	3	0.241	Not Achieved	55.97%	Achieved
5	5	4	3.956	Achieved	98.12%	Achieved
6	4	2	0.087	Achieved	52.17%	Achieved
7	6	2	2.461	Achieved	92.14%	Achieved
8	6	6	7.825	Achieved	99.96%	Achieved
9	5	5	5.297	Achieved	99.50%	Achieved
10	5	5	5.297	Achieved	99.50%	Achieved
11	5	5	5.297	Achieved	99.50%	Achieved
12	5	6	6.638	Achieved	99.87%	Achieved
13	5	4	3.956	Achieved	98.12%	Achieved
14	7	4	6.33	Achieved	99.82%	Achieved
15	6	6	7.825	Achieved	99.96%	Achieved
16	5	4	3.956	Achieved	98.12%	Achieved
17	6	6	7.825	Achieved	99.96%	Achieved
18	2	3	-0.946	Not Achieved	27.97%	Not Achieved
19	5	5	5.297	Achieved	99.50%	Achieved
20	4	3	1.428	Achieved	80.66%	Achieved

[a] Equation (9) refers

[b] Probabilities = $1/(1+e^{-[-7.343+1.187(t\_10)+1.341(t\_25)]})$

[c] One case was wrongly classified and 95% of testing data (Set B) correctly classified

Table 11 Model Validation of LR model of "Maintaining Parties' Relationship" Negotiation Outcomes

Set B: Testing Data (20 cases)				Cut-off Value = 50%	
No	t_12	Y-scores [a]	Original	Probabilities [b]	Prediction [c]
1	7	3.462	Achieved	96.96%	Achieved
2	5	1.934	Not Achieved	87.37%	Achieved
3	6	2.698	Achieved	96.69%	Achieved
4	3	0.406	Not Achieved	60.01%	Achieved
5	6	2.698	Achieved	96.69%	Achieved
6	4	1.17	Not Achieved	76.31%	Achieved
7	7	3.462	Not Achieved	96.96%	Achieved
8	6	2.698	Achieved	96.69%	Achieved
9	6	2.698	Achieved	96.69%	Achieved
10	5	1.934	Achieved	87.37%	Achieved
11	4	1.17	Achieved	76.31%	Achieved
12	6	2.698	Achieved	96.69%	Achieved
13	6	2.698	Achieved	96.69%	Achieved
14	7	3.462	Achieved	96.96%	Achieved
15	6	2.698	Achieved	96.69%	Achieved
16	3	0.406	Not Achieved	60.01%	Achieved
17	6	2.698	Achieved	96.69%	Achieved
18	4	1.17	Achieved	76.31%	Achieved
19	6	2.698	Achieved	96.69%	Achieved
20	6	2.698	Not Achieved	96.69%	Achieved

[a] Equation (10) refers

[b] Probabilities = $1/(1+e^{-[-1.886+0.764(t\_12)]})$

[c] Six cases were wrongly classified and 70% of testing data (Set B) correctly classified

Table 12 Model Validation of LR model of "Position Clarification" Negotiation Outcomes

Set B: Testing Data (20 cases)						Cut-off Value = 50%	
No	t_17	t_18	t_24	Y-scores [a]	Original	Probabilities [b]	Prediction [c]
1	6	3	6	4.866	Not Achieved	99.24%	Achieved
2	5	1	5	0.983	Achieved	72.77%	Achieved
3	7	2	6	2.276	Achieved	90.69%	Achieved
4	3	4	5	7.593	Achieved	99.95%	Achieved
5	3	6	6	12.636	Achieved	100.00%	Achieved
6	5	4	6	7.456	Achieved	99.94%	Achieved
7	6	5	5	5.543	Achieved	99.61%	Achieved
8	5	1	6	3.166	Achieved	95.95%	Achieved
9	3	2	5	4.733	Not Achieved	99.13%	Achieved
10	5	3	5	3.843	Achieved	97.90%	Achieved
11	3	4	6	9.776	Achieved	100.00%	Achieved
12	6	5	6	7.726	Achieved	99.96%	Achieved
13	3	5	5	9.023	Achieved	99.98%	Achieved
14	7	4	4	0.77	Achieved	68.35%	Achieved
15	5	6	6	10.316	Achieved	100.00%	Achieved
16	4	3	3	0.637	Achieved	65.41%	Achieved
17	5	1	6	3.166	Achieved	95.95%	Achieved
18	6	2	4	-0.93	Achieved	28.29%	Not Achieved
19	4	3	6	7.186	Achieved	99.92%	Achieved
20	6	1	4	-2.36	Achieved	8.63%	Not Achieved

[a] Equation (11) refers

[b] Probabilities = $1/(1+e^{-[-5.562-1.160(t\_17)+1.430(t\_18)+2.183(t\_24)]})$

[c] Four cases were wrongly classified and 80% of testing data (Set B) correctly classified

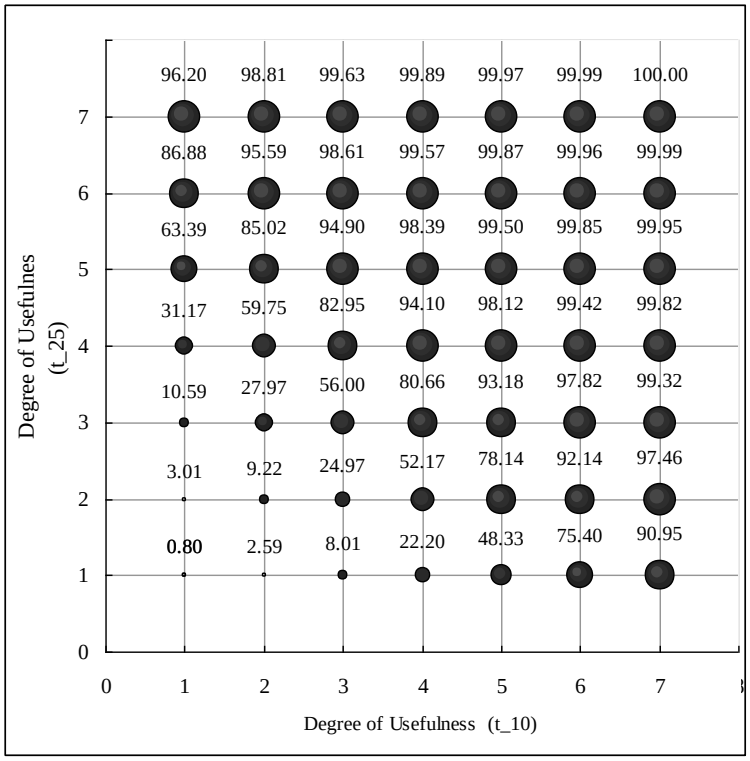

Figure 2 Probabilistic map showing the probability of achieving 'Substantial Improvement' negotiation outcome versus the degree of usefulness of tactics t_10 and t_25

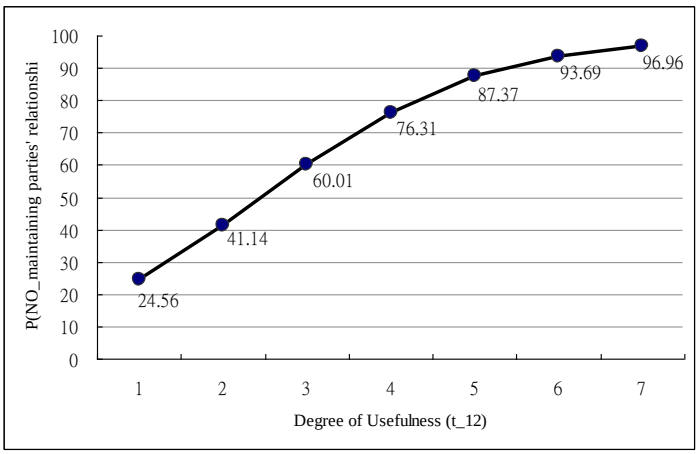

Figure 3 Probabilistic map showing the probability of achieving ‘Maintaining Parties’ Relationship’ negotiation outcome versus the degree of usefulness of tactics t_12