Schedule Risk Management of IT Outsourcing Project Using Negotiation Mechanism

Hua-ling Bi, Xiang Jia, Fu-qiang Lu*, Min Huang
(College of Information Science and Engineering, Northeastern University, Shenyang, China 110819)
(*e-mail fqlu@neuq.edu.cn)

Abstract - Schedule risk control is a very important issue for the success of IT outsourcing project. There are two independent agents in IT outsourcing project, which is the client and the vendor, the two sides need to reach an agreement on the schedule and cost of the project. However, traditional schedule risk control methods haven’t taken this characteristic of IT outsourcing into account. Given that, this paper analyze the characteristic of IT outsourcing with negotiation mechanism. We formulate the negotiation protocol that the two sides need to obey in the process of negotiation, design the decision making model and concession functions. Based on the simulation results, the effectiveness of the negotiation mechanism is verified. We also analyzed the influence of maximum negotiation rounds and concession factors on the negotiation results.

Keyword - IT outsourcing, Schedule risk management, Negotiation, Project management

I. INTRODUCTION

In recent years, information technology plays an increasingly important role in business process and routine work of enterprises. The main advantage of IT outsourcing is reducing cost, focusing on core competition and get access to latest technology, which is also the motivation of enterprises to choose IT outsourcing[1-2]. Meanwhile, enterprises might encounter many potential risks when outsourcing their IT work, which include business uncertainty, loss of innovative capacity and cost overrun caused by project delay [3-5]. Among them, the success of IT outsourcing projects depend on whether we can control the schedule effectively, which gains widespread attention in recent years.

PERT/CPM, critical chain, event chain, Gantt chart and milestones method are the traditional schedule risk control methods[6-8]. However, IT outsourcing project is different from the traditional software project. Therefore, the schedule risk control methods mentioned above can’t apply to the field of IT outsourcing directly, the main reasons are as follows. Firstly, schedule and cost of traditional software projects are determined by the enterprise itself, the project are implemented by the enterprise itself as well. But the schedule and cost of IT outsourcing project should meet the requirement of the two sides and at the same time, the project is implemented by vendor [9]. Secondly, traditional software project management tends to take only one factor into account, which is schedule or cost. Traditional method tends to satisfy the requirement on schedule but with a high cost, or satisfy the requirement on cost but with a high schedule. Therefore, if we give a comprehensive consideration of both schedule and cost, the enterprise’s interest will be better served [10]. Finally, the effect of the schedule risk control method ensures the project implemented according to the plan. But if schedule and cost of the project is unreasonable, the project delay is inevitable even though we apply the schedule risk control method mentioned above. Therefore, determination of reasonable schedule and cost is also important.

The client and vendor in an IT outsourcing project have varied preference over schedule and cost. They all expect that the distribution scheme of schedule and cost are as favorable to them as possible [11-12]. But differently, the client prefers that the value of schedule and cost is as large as possible, vendor prefers that the value of schedule and cost is as small as possible. However, the difference between the two sides’ preference is non-confrontation. Generally, we can get a result that is beneficial to both sides. The two sides should take some measures in order to reach an agreement. The effective ways to solve this kind of non-confrontation disputes and conflicts are negotiation, mediation and arbitration [11-14]. Negotiation is an effective way that agents communicate and compromise to reach a mutually beneficial agreement [15]. Available literatures apply negotiation to the field such as electronic commerce and multi-agent systems mostly [16-19]. The model that widely used is bargain model [20]. Bargaining theory mainly research on the situation that two parties expect to reach an agreement but have contradiction in how to cooperate.

This paper describes the interaction process by negotiation, designs the negotiation protocol of both sides, and establishes the decision-making model correspondingly. The two parties’ concession strategy was given, the model also give a comprehensive consideration of schedule and cost. Finally, we make experimental analysis under different concession strategy of both sides and maximum negotiation rounds.

II. BILATERAL NEGOTIATION MODEL

A. Basic assumptions

There is a situation in practice that the client and vendor have a long-term friendly relations and cooperation in IT outsourcing. As a result, client tends to designate a vendor to undertaken the IT outsourcing project. Generally speaking, the IT outsourcing project consists of some sub-projects, both sides should reach an agreement on schedule and cost by negotiation [21]. In this condition, we analyze the problem with an alternating offers protocol and gives out a bilateral multi-issue negotiation model. Before establishing the model, we need to make some basic
assumptions as follows:
1. The cost of negotiation is neglected.
2. The offer evaluation function is monotonous. The preference for both sides on the schedule and cost is fixed.
3. Before the start of negotiation, the two sides have complete information about each other, except the reservation utility and utility of each round.
4. Time is valuable to both sides. The two parties will set the maximum negotiation rounds for the negotiation; they all expect to reach an agreement in the limited rounds.
5. Both sides are self-interested, all of them expect to maximize their utility.

B. Negotiation issues and Standardization

The IT outsourcing project is divided into \( m \) sub-projects. Before negotiation, they often set bounds for schedule and cost of each sub-project. Both sides need to negotiate between the bounds \([22-23]\). The two sides exchange their schedule and cost of each sub-project, schedule and cost of the whole project consists of each sub-projects’ schedule and cost. Client prefers that the value of schedule and cost as large as possible. Instead, vendor prefers that the value of schedule and cost as small as possible. Therefore, we can consider that the lower limits of schedule and cost depend on vendor’s lower limits, the upper limits of schedule and cost depend on client’s upper limits. The parameters are defined as follows:

- \( \mathcal{S} \): Client
- \( \mathcal{B} \): Vendor

- \( x_{\max}^j \): The maximum value of schedule \( d \) or cost \( c \) for sub-project \( j \), \( x_{\max}^j = (c_{\max}^j, d_{\max}^j) \).
- \( x_{\min}^j \): The minimum value of schedule \( d \) or cost \( c \) for sub-project \( j \), \( x_{\min}^j = (c_{\min}^j, d_{\min}^j) \).
- \( s^j \): The minimum and maximum value of schedule for sub-project \( j \) respectively.
- \( c^j \): The minimum and maximum value of cost for sub-project \( j \) respectively.
- \( x^{j,t} \): The client’s offer for sub-project \( j \) in round \( t \), \( x^{j,t} = (c^{j,t}, d^{j,t}) \).
- \( x^{j,t} \): The vendor’s offer for sub-project \( j \) in round \( t \), \( x^{j,t} = (c^{j,t}, d^{j,t}) \).
- \( X_s^t \): The client’s offer for the whole project in round \( t \), \( X_s^t = (x_{s,1}^t, x_{s,2}^t, \cdots, x_{s,n}^t) \).
- \( X_b^t \): The vendor’s offer for the whole project in round \( t \), \( X_b^t = (x_{b,1}^t, x_{b,2}^t, \cdots, x_{b,n}^t) \).

Client and vendor have varied weights on each sub-projects’ schedule and cost. Different level of weight can be expressed by a number which is called weight. The larger the number is, the more important this item is. Meanwhile, the value of weights are constant which won’t change with time. The parameters are defined as follows:

- \( w_s^j \), \( w_b^j \): The weight of sub-project \( j \) for client and vendor respectively.
- \( w_c^j \), \( w_d^j \): Client’s weight on schedule and cost for sub-project \( j \) respectively.
- \( w_d^j \), \( w_c^j \): Vendor’s weight of schedule and cost for sub-project \( j \) respectively.

The dimensions of schedule and cost are different. In order to calculate and compare those issues, we need to make them in non-dimensional state which is called standardization. This paper applies transform formulas below to standardize those issues, making them in the range of \([0, 1]\). Put differently, for client, the smaller schedule and cost, the larger its interest. Therefore, its standardized formulas is shown as formula (1). For vendor, the greater schedule and cost, the greater its interest, its standardized formulas is shown as formula (2).

\[
V^s(x^{j,t}_s) = \frac{x^{j,t}_s - x^{j,t}_s}{x^{j,t}_s - x^{j,t}_s} \tag{1}
\]

\[
V^b(x^{j,t}_b) = \frac{x^{j,t}_b - x^{j,t}_b}{x^{j,t}_b - x^{j,t}_b} \tag{2}
\]

C. Negotiation framework

The whole negotiation framework includes three parts, which include negotiation issues, interaction mechanism and utility evaluation mechanism. Interaction mechanism describes the alternating offers process, this paper adopts the alternating offers model of Rubinstein to describe this process. The process is shown in fig.1.

Before negotiation, the two sides should discuss the maximum negotiation round \( t_{\max} \) of the project, provide their negotiation range of each sub-project, and alternate their weights for each sub-project and weights for schedule and cost of each sub-project. Among those, their concession strategies and reservation utilities are private information. That is to say, they won’t inform the other side of their concession strategies and reservation utilities. In this way, they can force the other side to provide a reasonable price. Neither side will benefit from a failure negotiation, therefore, both sides hope to reach an agreement in a limited rounds.

Figure 1 can be divided to the following steps:

\textbf{Step 1}: The rounds add 1 which is described as \( t = t + 1 \). If \( t \leq t_{\max} \), client put forward it’s utility demand according to its concession strategy and go to Step 2. Otherwise, go to Step5.

\textbf{Step 2}: Vendor received client’s utility demand, generating