RESEARCH ON PRINCIPLE-BASED CONTRACT DISPUTE NEGOTIATION SYSTEM : A CASE IN CONSTRUCTION INDUSTRY

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Abstract:

Contract dispute resolution has become an important aspect in the negotiating process. Objective and effective contract dispute resolution can reduce the high transaction cost and time in the negotiation process. This paper proposes a principle-based contract dispute negotiation system based on expert system and knowledge resource space model (KRSM). The system provides an accurate and objective discriminant model to determine which party is responsible for the loss from the dispute. The case of a construction contract proves the practicality of the proposed system, which provides guidelines for the contract dispute resolution in construction industry.

Key words: Principle-based Negotiation system, Contract dispute, Expert system, Knowledge-resource space model
1 INTRODUCTION

Negotiation is a decision process for two or more parties to make individual decisions and interact with each other for mutual interest (Thompson 1998). Traditionally, a contract is an outcome associated with negotiation, which is a binding agreement between the negotiating parties defining the set of obligations and rewards in the business process (Raiffa 1982). This process reduces the uncertainty of negotiators in the communicating process. Although the negotiation of contracts involves two or more parties bargaining multilaterally to achieve a mutual beneficial agreement, each of them may have conflicting interests. Since each party has its own final purpose, they tend to ignore of the others’ thoughts and values, especially in an environment without cooperation (Chiua et al. 2005). During the process, the uncomprehensive coverage and controversial in the text of contract also involve the understanding deviations of the partners in many countries, especially in developing countries like China (Qu 2012). As a result, the negotiating process may bind with a numbers of disputes. Since the disputing parities asked the arbitration or the third party for help. However, the process is in poor efficiency with high transaction costs and time (Hornle 2001). Therefore, how to solve the contract dispute is of great importance.

With rapid development of e-commerce, the online negotiation activities have become a global communication platform to reduce the high costs and time significantly, as well as the conflicts among the partners (Kilgour and Eden 2010). Electronic negotiation systems, which are web-based models of negotiation support systems, allow parties in various places to seek acceptable agreements on both sides by exchanging demands through the networks in a structured or unstructured fashion (Carbonneau et al. 2011). Internet negotiation activities are highly-effective, which avoid issues of place, time, even culture, ego and pride.

Most negotiation tools, such as Online Dispute Resolution (ODR), further expand the trend of internet negotiation activities based on utility theory (Hasan and Serguijevskaia 2006). Such agreement supports an unstructured interaction among the partners according to the parties’ preferences or tradeoffs. However, this optional nature cannot be used to educe a right-based and enforceable decision, which is difficult for negotiation mechanism to use and provide users with better feasible solutions. Therefore, negotiation tools such as ODR should make the structured information such as rules, standards and laws as the basis for the settlements or decisions.

A burgeoning body of research has started to theorize about the effect of artificial intelligence in dispute resolution (Riad et al 1991; Dickmann and Kim 1992; Molenaar et al. 2000; Cheung et al.2001). Specially, legal expert system has attracted immense research interest since 1992 (Dickmann and Kim 1992; Greinke 1994; Stranier et al. 1999; Alevcn 2003), which is a type of knowledge-based technology in a structured interaction. However, most of the legal expert systems mentioned were aimed to lawyers from different theoretical perspectives, ignoring the real impact on ordinary citizens (Rissland et al. 2003). Though Diekmann (1992), Rissland et al. (2003) proposed special expert systems for the use of layman, there has been little work on the actual resolution of contract disputes, especially concrete solving the processes based on an actual case.

Currently Yuan et al. (2003) have discussed the differences and influence of various negotiations in
the network. They have built architecture for principle-based dispute resolution systems for consumers. Here, based on the principle-based dispute resolution, the disputants can find dispute resolutions in terms of established principles in legal laws, contract and consumer protection warranty plans (Xu and Yuan 2009). However, the writers have not discussed how to address the complexity and variety of principles and dispute cases which could hinder the whole system from running efficiently.

However, there are three significant gaps in the previous studies. First, although most negotiation tools such as ODR have a positive effect on settling the contract dispute, the weaknesses of the unstructured interaction reduce the reliability and execution of the final result to a large extent, and no studies have solved these problems. Second, the existing researches are the lack of a systematic and macro review of the literature on management of construction contract disputes, which fails to provide any meaningful results in light of actual case studies. Finally, consistent with Xu and Yuan (2009), the principle-based dispute resolution system is incomplete due to the complexity and variety of principles and dispute cases in which the authors do not investigate how to process such complexity.

Drawing from relevant theories, the main objective of this study is to investigate how to create fair and just contract negotiation according to a principle-based dispute negotiation system. Specially, in order to reduce the complexity and variety of principles and dispute cases, we bring the knowledge resource space model (KRSM) into the whole system, which is suitable for specifying, sharing, managing various Web resources and improving the overall efficiency of the system operation.

The paper is organized as follows. In the next section, we describe the architecture for principle-based dispute negotiation system based on expert system. We then describe the steps of a principle-based dispute resolution process and illustrate the use through a real case. Finally, we discuss the theoretical and practical implications of our study.

2 ARCHITECTURE OF PRINCIPLE-BASED CONTRACT DISPUTE NEGOTIATION SYSTEM

2.1 The architecture of the system

In this section, we discuss the architecture of principle-based contract dispute negotiation system for resolving the disputes which is based on Xu and Yuan (2009). Because the complexity and variety of principles and dispute cases have not been discussed by Xu and Yuan (2009), we revise the original architecture based on a knowledge resource space model to solve this problem as shown in Fig.1.

The revised architecture mainly reflects the relationships and interactions among factors, consisting of three layers: principle layer, inference layer and debate layer. The first layer is the principle layer, which is the main theoretical basis to settle the dispute. The second one is used to inference the negotiation rules. The last layer is the main interface for negotiation partners to communicate and exchange with each other. Associated with each layer do the informations transmit and update in time, supporting the coordinated operation of the whole negotiation system.

The first layer is the principle layer, which stores and manages the principles as well as transforming
them into rules. All principles originally in relevant documents can be stored, specified, shared and managed in the principle base. Then, they are transformed into rules that can be understood by the inference layer. The principle storage includes the principle of laws, administrative regulations and industry rules.

The second layer is the inference layer, which acts as a linkage between the principle layer and the debate layer. It contains the rule base, an inference engine, and an expert interface. The rule base stores the rules from principle layer. According to those rules and the arguments submitted by the disputing parties at the debate layer, the inference engine will derive a recommended verdict. Then, the legal experts receive the verdict and check it in order to make the recommended verdict accurate. If it is thought to be reasonable, the verdict will be returned to the disputants through the inference engine.

The last layer is the debate layer. It makes the disputants interact with each other by a negotiation platform. It pays more attention to individual behavior factors compared with the problems, allowing the disputants to submit each’s arguments (such as fact and claim). The arguments of the disputants are selected through investigation and interview, and stored in the negotiation platform, then submitted to inference engine. When the two disputing parties receive the verdict from the inference engine, they can negotiate with each other on the negotiation platform and submit new arguments to the inference engine. Then, the inference engine will get a new recommended verdict. Finally, the disputants can adopt some reasonable and fair strategies to attain a win–win solution for their disputes, based on the recommended verdict (Kersten and Noronha 1999).

![Diagram of the revised principle-based contract dispute negotiation system architecture](image)

**Figure 1.** The revised principle-based contract dispute negotiation system architecture based on Xu and Yuan (2009).
2.2 Knowledge Resource Space Model (KRSM)

In the principle layer, the principle base contains various theoretical principles in relevant documents, including disputants’ contract and numerous legal provisions from the network. Since the collaborative network may adopt various principle representation mechanisms, principle transformation is hampered by the fussy mechanisms (Liu et al. 2011). To ensure effective means to organize retrieve and manage principles distributed across the network, we introduce a knowledge resource space model to address this problem.

A knowledge resource space model (KRSM) has been widely applied in various fields, including traditional Chinese medicine (Chen et al. 2003), intelligent transport system (Wu et al. 2005), meteorology (Xiao et al. 2003), P2P resource system (Liu et al. 2006) and intelligent recommendation in e-commerce (Liu 2006). It is an effective knowledge management model proposed in 2004 based on Semantic Grid VEGAKG in form of knowledge (Zhuge 2004). Semantic Grid VEGAKG absorbs the ideal of Grid and the standards of the semantic web, adopting a uniform resource-using mechanism (Zhuge, 2002). In term of Semantic Grid VEGAKG, KRSM can be expressed as a set of inter-related resources, denoted as KS (X₁, X₂, X₃,..., Xₙ). Xᵢ is the name of an axis. Xᵢ={ Cᵢ₁, Cᵢ₂, Cᵢ₃,..., Cᵢₙ} represents an axis with its coordinates and the order between them.

Zhuge (2002) proposed a global knowledge grid model, which includes three-dimensional knowledge space: knowledge-category, knowledge-level, location. The former two dimensions identify knowledge content, and the third one identifies the locations of storing knowledge. The users can use knowledge grid operation language to create, store, modify and search knowledge grids in order to realize sharing and managing global knowledge. Based on the works of Zhuge, we will introduce KRSM into the principle base of the principle layer, which is a three-dimensional knowledge model with knowledge-category, knowledge-level and knowledge-location.

In KRSM, each knowledge-category can identify one type of various documents knowledge, such as the knowledge of surveying, designing or construction in the construction industry. Knowledge-level is used to identify the level of document knowledge based on some key words. For example, with reference to legal construction acts, knowledge-level can be organized in a hierarchy of three levels. The top level is laws made by the government (Building Law, Contract Law, Construction Engineering Quality Management Regulations etc.). The second level includes industry regulations. The last contains negotiation agreements such as legal agreement documents (contracts, warranty plans, etc.). Knowledge-storage utilizes computing technology, like universal knowledge location (UKL), to accurately locate where the knowledge is stored in the network for inference layer (Zhen 2008). Each point in KRSM represents knowledge at a certain knowledge level of a knowledge category and is stored at a certain location as shown in Fig.2 (Zhuge 2002).

As pointed out by H. Zhuge, the design process of KRSM consists of the following steps. The first step is to survey the resources need to be managed and analysis the structural characteristic of principle resource based on XML. Then, partition top-down resource and design two-dimensional resource spaces. The last one is to join between resource spaces into three dimensions. Though XML and knowledge grid operation language, KRSM can timely update and find out which principles imbedded in these documents is suitable for the case (Zhuge et al. 2005; Liu et al. 2006).
3 AN EMPIRICAL STUDY TO EXAMINE THE NEGOTIATION SYSTEM

3.1 The logical process of the system

There are six steps in the implementation of a principle-based dispute resolution system. The first step is to analyze the background of the case, by which the applicable documents items are summed up and KRSM of the system is established in the principle layer. The second step is to establish contract dispute rule base and the next is to identify the actual situations and needs of disputing parties, where inspectors check and verify the situations and needs to make necessary corrections, then forward them to the inference engine. Based on the second and third steps, the system generates respectively beneficial solutions of disputing parties using forward and backward chaining reasoning, which happens in the inference layer. Finally, the system gets the final verdict compared with the output from legal expert. The six steps are shown in Fig.3.

![Diagram of the logical process of the system]

Figure 3. The steps of principle-based contract dispute negotiation system
3.2 Analysis of the case background

Most modern organizations are eager to utilize latest technological development (i.e. electronic negotiation activities) to stay competitive in the marketplace. The construction industry is no exception (Land et al. 2002). We use a real contract dispute case in construction industry to illustrate the principle-based contract dispute negotiation system. The case was a construction contract dispute as the main type of contract disputes in construction industry of China.

The case describes a dispute between the owner and the contractor. In 2007, the owner and the contractor signed a construction contract, while, the contract was broken up because of the disputes during the process. After a while, the contractor requested the owners to fulfill its payment obligations immediately after the completed project was accepted by the owner. While, the owner argued that there were some damages in the completed project and requested the contractor to make up for the damages. On the contrary, the contractor warranted that there were no damages in the completed project. Based on these, the regulation documents related to this construction case were sorted out and summarized in Table 1.

In terms of the background, the principle base utilizes KGOL and XML to create and update KRSM.

<table>
<thead>
<tr>
<th>Government law</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Law</td>
</tr>
<tr>
<td>Contract Law</td>
</tr>
<tr>
<td>Construction Engineering Quality Management Regulations</td>
</tr>
<tr>
<td>Construction Contract Disputes Judicial Interpretation</td>
</tr>
<tr>
<td>Construction Contract</td>
</tr>
</tbody>
</table>

*Table 1. The regulation documents related to the construction case*

3.3 Establishment of the system

In this step, the suitable principles are transformed into rules stored in the rule base as shown in Table 2. Expert shells such as CLASP can perform the rule checking (Xu and Yuan 2009).

<table>
<thead>
<tr>
<th>Principle</th>
<th>Rules</th>
</tr>
</thead>
</table>
| “Once the project is accepted by the owner, the owner shall fulfill its payment obligations timely. Except for permits and fees that are the responsibility of the contractor under the Contract documents, the owner shall secure and pay for the project funds owed to the contractor in the same period bank loans interest, as a compensation for damage to the contractor until all principal and interest is off.” (Clause (20) in the Construction Contract, 2007) | Rule: R1  
IF: The contractor completes the project  
AND The project is accepted by the owner  
AND The owner delays fulfilling its payment obligations  
THEN: The owner shall be responsible for the loss |
“If the contractor encounters conditions at the site that are war, hostilities, foreign enemy actions, military coup, strike or shutdown caused by other reasons and the other condition circumstances set by local meteorological units, seismic units, health units and special terms, the owner shall be responsible for the costs and damages resulting from labor, materials, equipment, tools and completion of the construction.”
(Clause (20) in an Extras Agreement, 2007)

“Rule:
R2
IF: The samples of item are described in contract
THEN: The item accords with samples

Rule:
R3
IF: The item accords with samples
THEN: The owner shall be responsible for the loss

“The contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work. If the Work has problems, the contractor shall repair.”
(Clause (20) in Building Law, 2011)

“Rule:
R4
IF: The Work has problems
AND The owner does not get consent from the contractor
THEN: The contractor shall be responsible for the loss

“(1) The contractor warrants that the contraction will conform to the requirement of the Contract Documents and will be responsible for the loss during the warranty.”

(2) Subsection (1) does not apply where,
a. The construction is beyond the warranty
b. The owner, having been notified, does not file the lawsuit within two years after executing the contract or within such other time period as may be agreed; or
c. An item selected under clause (a) and (b) are not available and the purchaser does not file the lawsuit within two years of receiving written notice from the contractor or the disputants put forward other requirements or agree to fulfillment of obligations

(Clause (41), (45) in Construction Engineering Quality Management Regulations, 2000)

“Rule:
R5
IF: the construction has problems during the warranty
AND The owner does not get consent from the contractor
AND The exception (a) doesn’t exist
AND The exception (b) doesn’t exist
AND The exception (c) doesn’t exist
THEN: The contractor shall be responsible for the loss

Rule:
R6
IF: The construction is during the warranty
THEN: The exception (a) doesn’t exist

Rule:
R7
IF: The construction is beyond the warranty
THEN: The owner shall be responsible for the loss

Rule:
R8
IF: The owner is not been notified
OR The owner files the lawsuit during the warranty
THEN: The exception (b) doesn’t exist

Rule:
R9
IF: The owner is been notified
AND The owner does not file the lawsuit during the warranty
THEN: The owner shall be responsible for the loss

Rule:
R10
IF: The owner is not been notified
OR The owner files the lawsuit during the warranty
The disputants don’t put forward other requirements or agrees to fulfillment of obligations
THEN: The exception (c) doesn’t exist
Rule: R11
IF: The owner is been notified
AND The owner files the lawsuit during the warranty
AND The disputants put forward other requirements or agree to fulfillment of obligations
THEN: The owner shall be responsible for the loss

Table 2. Principles applied to case rules

3.4 Identification of actual situations and needs of disputants

Through investigating the case, we submit arguments from the both disputants in a structured format as shown in Table 3. The format consists of two parts, including fact and claim. A fact is a description of the facts related to the dispute. A claim is the goals what the disputants ask for.

<table>
<thead>
<tr>
<th>Owner</th>
<th>Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fact</strong></td>
<td><strong>Fact</strong></td>
</tr>
<tr>
<td>1. The contractor completes the project</td>
<td>1. The contractor completes the project</td>
</tr>
<tr>
<td>2. The project is accepted by the owner</td>
<td>2. The project is accepted by the owner</td>
</tr>
<tr>
<td>3. The owner delay fulfilling its payment obligations</td>
<td>3. The owner delay fulfilling its payment obligations</td>
</tr>
<tr>
<td>4. The Work has problems</td>
<td>4. The Work has no problems</td>
</tr>
<tr>
<td><strong>Claim</strong></td>
<td><strong>Claim</strong></td>
</tr>
<tr>
<td>The contractor shall be responsible for the loss</td>
<td>The owner shall be responsible for the loss and payment</td>
</tr>
</tbody>
</table>

Table 3. The arguments of disputants

In order to make the arguments correct, the system submits the arguments to the construction contract dispute resolution inspectors. They are arranged to verify the facts and claims, especially those causing the dispute between the owner and contractor. Then the inspectors checks and verifies the fact in terms of the written documents and spot investigation. According to the inspectors’ witness, some parts of the completed project has existed some damages. Therefore, the project work has problems. All four pieces of facts verified by the inspectors are shown in Table 4.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description of facts</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACT 1</td>
<td>The contractor completes the project</td>
<td>Item 1 of facts submitted by Owner and Contractor</td>
</tr>
<tr>
<td>FACT 2</td>
<td>The project is accepted by the owner</td>
<td>Item 2 of facts submitted by Owner and Contractor</td>
</tr>
</tbody>
</table>
FACT 3  |  The owner delays fulfilling its payment obligations  |  Item 3 of facts submitted by Owner and Contractor  
FACT 4  |  The Work has problems  |  Facts submitted by Inspectors  
FACT 5  |  The owner does not get consent from the contractor  |  Facts submitted by Owner  

Table 4. Facts verified by the inspector

3.5 Generation of respectively beneficial solutions of disputants

The system stores the above verified facts into the negotiation platform, and then transmits them to inference engine. If the engine needs to verify new facts or conditions during inference, it will ask the inspectors some questions through the platform screen. In the light of the facts and rules, the inference engine chooses backward and forward chaining reasoning and to judge the claims and draw consequences, respectively.

The backward chaining reasoning process for contractor claims is described in Fig. 4. At first, the inference engine finds the related rules whose outputs match the contractor’s claim goal. Then each condition of related rules is checked in terms of the verified facts. If each condition of one rule can be satisfied by the verified facts, then it can be applied, and the contractor’s claim goal can be achieved.

![Figure 4. The process of contractor claim drawback reasoning](image)

According to Fig. 4, the inference engine finds the outputs of rules R1, R3, R7, R9 and R11 match the goal of the contractor’s claim. Since FACT1、FACT2 and FACT3 satisfy all conditions of R1, R1 can be applied, which means that the goal of the contractor’s claim can be achieved. The engine also finds that there are several uncertain conditions of R3, R7, R9 and R11. After asking the inspectors some questions, all of conditions are unsatisfied, so none of the four rules can be applied.

All replies of the questions are memorized by the system. After the claim of the contractor has been reasoned, the system can get the following additional verified facts based on the replies, including...
FACT6, FACT8, FACT9, FACT10, FACT11 and FACT12 in Table 5.

<table>
<thead>
<tr>
<th>No.</th>
<th>Additional Verified Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACT 6</td>
<td>The construction is beyond the warranty</td>
</tr>
<tr>
<td>FACT 7</td>
<td>The construction has problems during the warranty</td>
</tr>
<tr>
<td>FACT 8</td>
<td>The owner has been notified</td>
</tr>
<tr>
<td>FACT 9</td>
<td>The owner files the lawsuit during the warranty</td>
</tr>
<tr>
<td>FACT 10</td>
<td>The disputants refuse to put forward other requirements or agree to fulfillment of obligations</td>
</tr>
<tr>
<td>FACT 11</td>
<td>The samples of behavior of disputing parties described in contract</td>
</tr>
<tr>
<td>FACT 12</td>
<td>The samples of item described in contract</td>
</tr>
</tbody>
</table>

Table 5. Additional verified facts during the contractor’s claim reasoning process

For the owner, the backward chaining reasoning process is the same as the one for the contractor’s claim goal in Fig. 5. During the process, an additional fact FACT7 is verified in Table 5.

Figure 5. The process of owner claim drawback reasoning

In terms of FACT 4, FACT 5, FACT 6, FACT 7, FACT 8, FACT 9, FACT 10, FACT 11 and FACT 12, the inference engine makes a conclusion that R4 and R5 can be applied. At the same time, the goal of the contractor’s claim can be satisfied by R1.

However, since the claim goal of the owner’s conflicts with the one of the contractor’s, only one side’s goal can be achieved. With reference to the knowledge-level of KRSM in the principle layer, the principles have a level hierarchy, using as the source of R4 and R5 Building Law and
Construction Engineering Quality Management Regulations which falls into law, and the source of R1 falls into negotiation agreements. The principle R4 and R5 overrides R1. So the goal of the contractor will be attained based on Rule R4 and R5 whose source principles are Building Law and Construction Engineering Quality Management Regulations.

According to FACT 1 to FACT 12, the inference engine chooses the forward chaining reasoning to draw the consequences from the rules in Fig. 6. The consequences are “The rules R1, R4 and R5 can be applied”, the output of R1 are the same, the outputs of R4 and R5 are the same, but there are conflicts among the outputs. As described above, R4 and R5 can override R1, so R4 and R5 can be applied. The outputs of R4 and R5 are supported, which is “The contractor shall be responsible for the loss”.

\[ \text{FACT 1} \quad \text{FACT 2} \quad \text{AND} \quad \text{R1} \]
\[ \text{FACT 3} \quad \text{AND} \quad \text{R4} \]
\[ \text{FACT 5} \quad 
\[ \text{FACT 6} \quad \text{R6} \quad \text{R8} \quad \text{AND} \quad \text{R5} \]
\[ \text{FACT 9} \quad \text{FACT 8} \quad \text{AND} \quad \text{R10} \]

\[ \text{Figure 6. The process of forward chaining for conclusions} \]

3.6 Output Of The Final Verdict

Compared the final result from the backward chaining with the one from forward chaining, the inference engine finds no conflict. So, in terms of this case, the negotiation system gets the recommended verdict as “The contractor shall be responsible for the loss” based on the resource from Building Law and Construction Engineering Quality Management Regulations.

Then, the verdict of the system will be passed to legal experts through expert interface. The legal experts will then check the recommended verdict. In fact, the recommended verdict is consistent with the judgment made by legal experts from the court. Afterwards, the recommended verdict is sent to the disputing parties.

When the two disputants receive the verdict from the inference engine, they may adopt some reasonable and fair strategies to negotiate with each other on the negotiation platform. As a result, the contractor may pay the owner’s expenses and compensation made by the damages.

4 CONCLUSION

In this study, we attempt to solve the weaknesses of the contract dispute negotiation activities, especially in e-commerce environments, i.e., high cost, low efficiency and unstructured interactions
increasing the contract disputes. To derive the resolution, a revised principle-based contract dispute negotiation system is proposed based on Xu and Yuan (2009), after which we present the architecture and process of the whole system. Using a real case of a construction contract dispute in construction industry, we test the operation of the principle-based contract dispute negotiation system. We find that the recommended verdict is consistent with the judgment made by legal experts from the court, which highlights the significant role of the system in solving the contract disputes in construction industry.

For theoretical contribution, our study contributes to principle management. In terms of previous research of Xu and Yuan (2009), authors presented a principle-based dispute resolution system in the field of the real estate. This dispute resolution system has been applied in several fields, such as legislative (Violeta et al. 2010) and food (Elizabeta et al. 2011). However, few studies have examined the implement efficiency due to the complexity and variety of principles and dispute cases. By applying Zhuge’s (2002) global knowledge grid model, we introduce RSM into the architecture of principle layer in the system to build new KRSM. KRSM has a direct and effective impact on collecting, expressing, sharing and managing various web knowledge, which makes the system operate high efficiently and normatively.

In terms of contribution to practice, our study provides guidelines for the contract dispute resolution in the construction industry. The final verdict of the case study shows that the principle-based contract dispute negotiation system can replace the arbitrations to help the disputing parties to attain a win–win solution from an objective perspective. This system can avoid high cost and time, and make a convenient platform communication for the disputants.

This study also offers several potential future research directions. Firstly, since the principle-based contract dispute negotiation system is only applied in a construction contract dispute, it is difficult to conduct verification and validation of the system in all kinds of modern organizations from a quantitative aspect. We will use the system to solve the disputes among other industries and identify whether the system is generalizable to the other case study in the construction industry and other industries as well. Secondly, our arguments and case discussions are related to the framework of civil law system which is easier than the common law system. We need to apply the system in the common law system to proof the generalization. Additionally, there are several drawbacks in the method of fact investigation (high investigational cost, the investigators’ subjective prejudices influence etc.) which may make it to have a deep conversation among the disputants. We need to improve and modify the research method in order to respond to demands of both sides objectively, accurately and quickly.

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